Motors

Automation

Energy

Transmission and Distribution

Coatings

PUMP GENIUS

PG HMI with Integral PLC - Description of Operation (DofO)

Driving efficiency and sustainability

1. Introduction

The purpose of this document is to provide a description of operation for the Pump Genius (PG). The Human Machine Interface (HMI) is a CMT2078X. The PLC is a CODESYS soft PLC embedded in the HMI. PG can control up to five VFDs, starting and stopping the VFDs to evenly distribute run time. PG will start and stop pumps as needed to maintain the system setpoint. In low demand periods, PG will go into “sleep mode” and automatically restart from “sleep” based on the system variable. There are a number of options available for pump protection that will be discussed in more detail later in this document.

Configuration is done through the HMI that communicates with all of the VFDs in the pumping system. Monitoring of system operation is done through the same HMI. Communications with the VFDs in the pumping system is through an RS-485 interface on each VFD, the protocol for communications between the HMI and VFDs is Modbus RTU.

2. HMI

The following are the screens available in the PG HMI, with a brief description of the function of each of the screens.

2.1. Main Screen

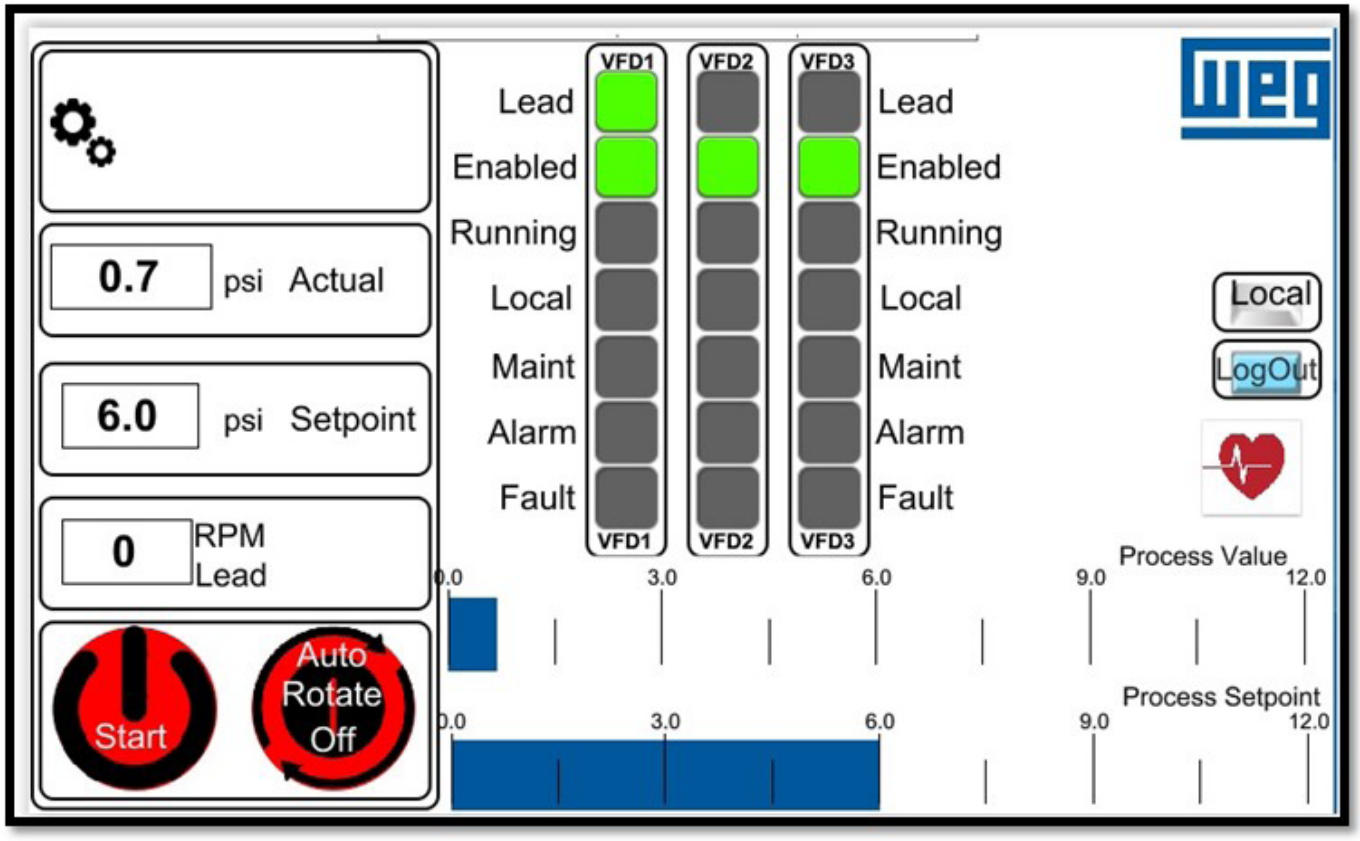

Figure 1: PG Main Screen

The heart symbol on the main screen should go off and on at two second intervals. The change of state of the heart symbol indicates the HMI and the integrated CODESYS PLC are communicating.

All data subject to change without notice

Description of the PG main screen:

Selects the Wizards select screen, refer to Figure 6.

System Start/Stop on the left and Auto Rotation on the right.
Auto Rotate must be on to force rotation of a single running Pump – refer to Figure 21.

The number of “stack lights”, on the HMI main screen, displaying VFD status changes depending on the number of VFDs configured in the system, the display shown in Figure 1 is for a system configured with three VFDs, VFD1-VFD3.

2.1.1 Main Screen Pop-Ups

A number of pop-up screens are accessible from the Main Screen. Selecting any of the lights for a VFD, i.e., Lead, Enabled, Running, etc., opens the pop-up shown in Figure 2.

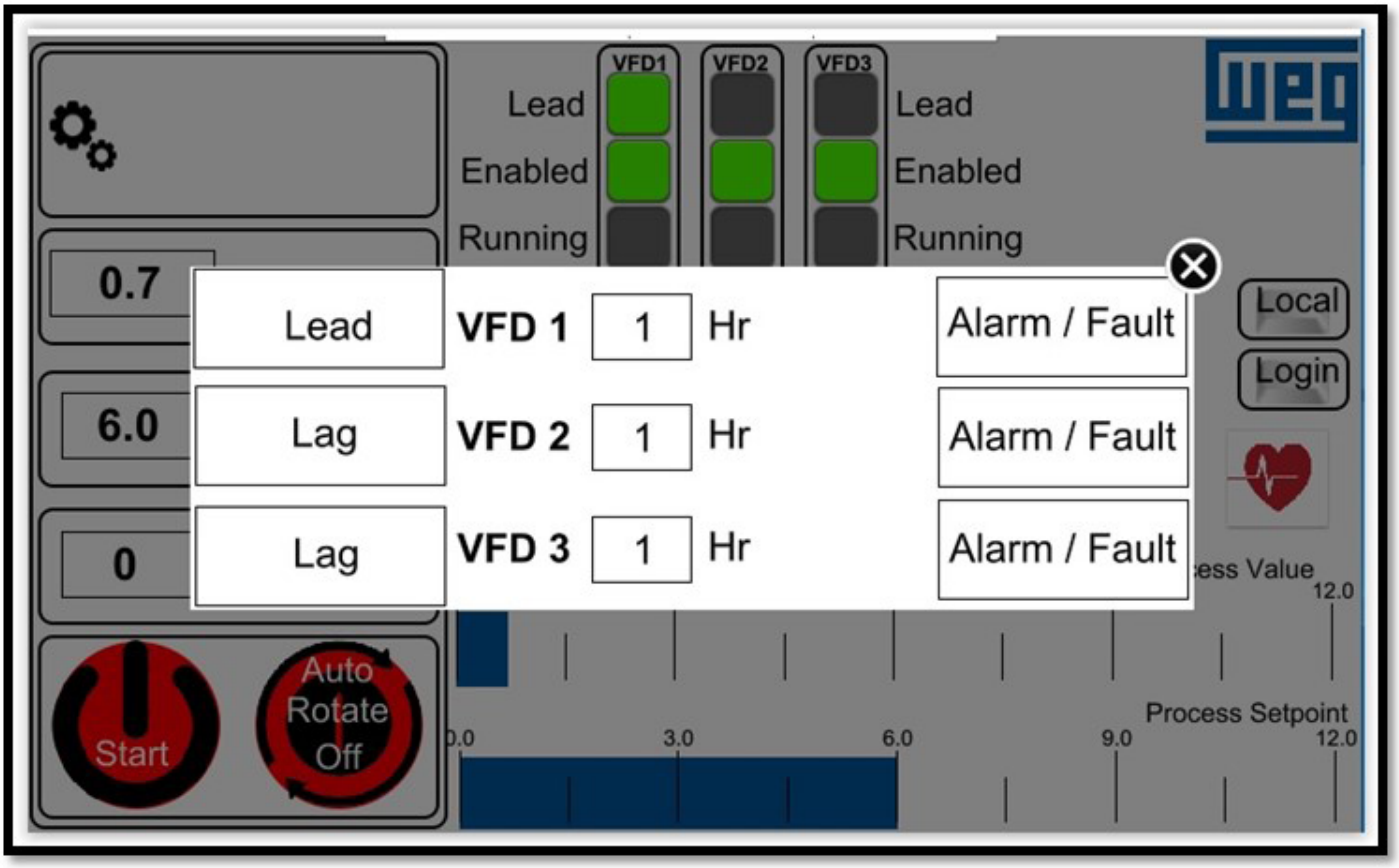

Figure 2: Lead/Lag/Run Time Pop-Up

The pop-up in Figure 2 shows the Lead/Lag status of a pump it also shows the run time accumulated on each pump. With Auto Rotate Off, the lead pump can be manually changed from this pop-up.

If “Auto Rotate” is on, PG will select the pump with the lowest runtime to start first. If the runtimes of all pumps are equal, the pumps will start in Modbus address order. Stopping order is opposite of the starting order, i.e., the pump with the highest runtime is stopped first.

Selecting the Alarm/Fault button for a VFD opens the Pop-Up shown in Figure 3.

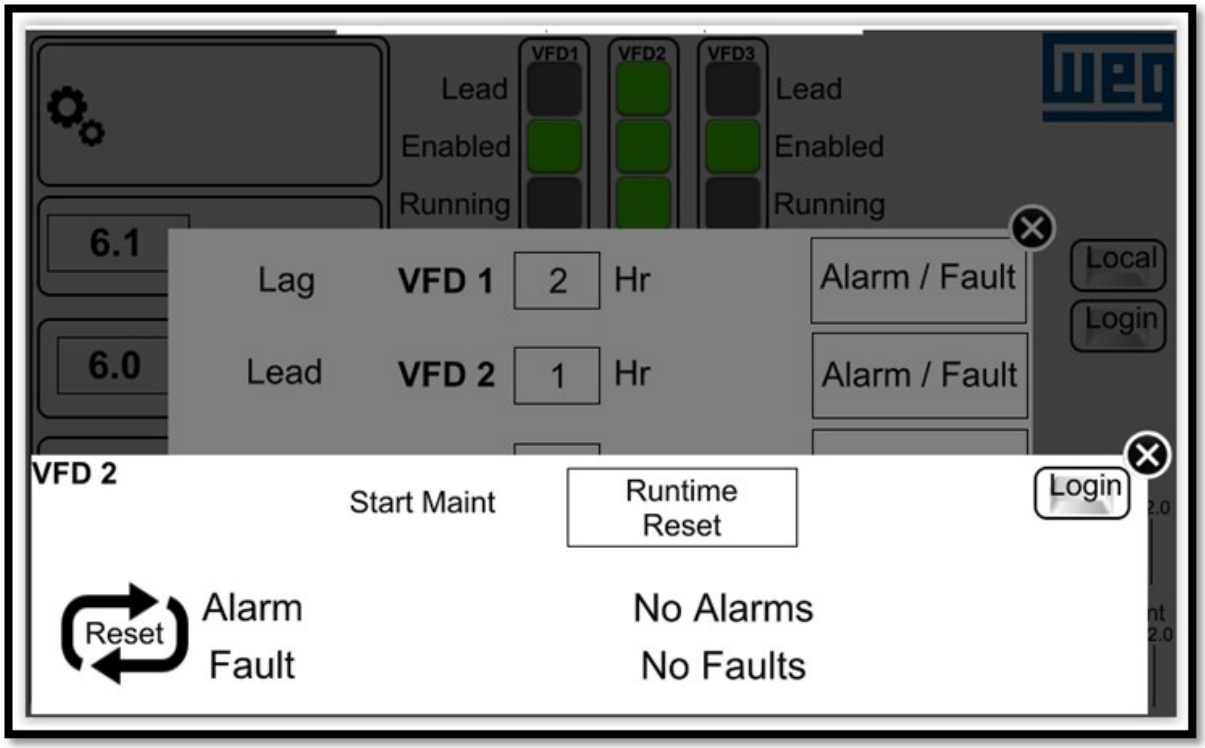

Figure 3: Alarm/Fault/Runtime Reset Pop-Up

Resets any active VFD Fault. Note: Using the Reset speeds up the recovery after a drive communications interruption.

Can be used to take a pump out of service for maintenance
Note: The Lead pump cannot be put in maintenance directly - in Figure 3, to put pump 2 in maintenance, first, manually force a lead change.

Can be used to reset the run time for the selected VFD/pump

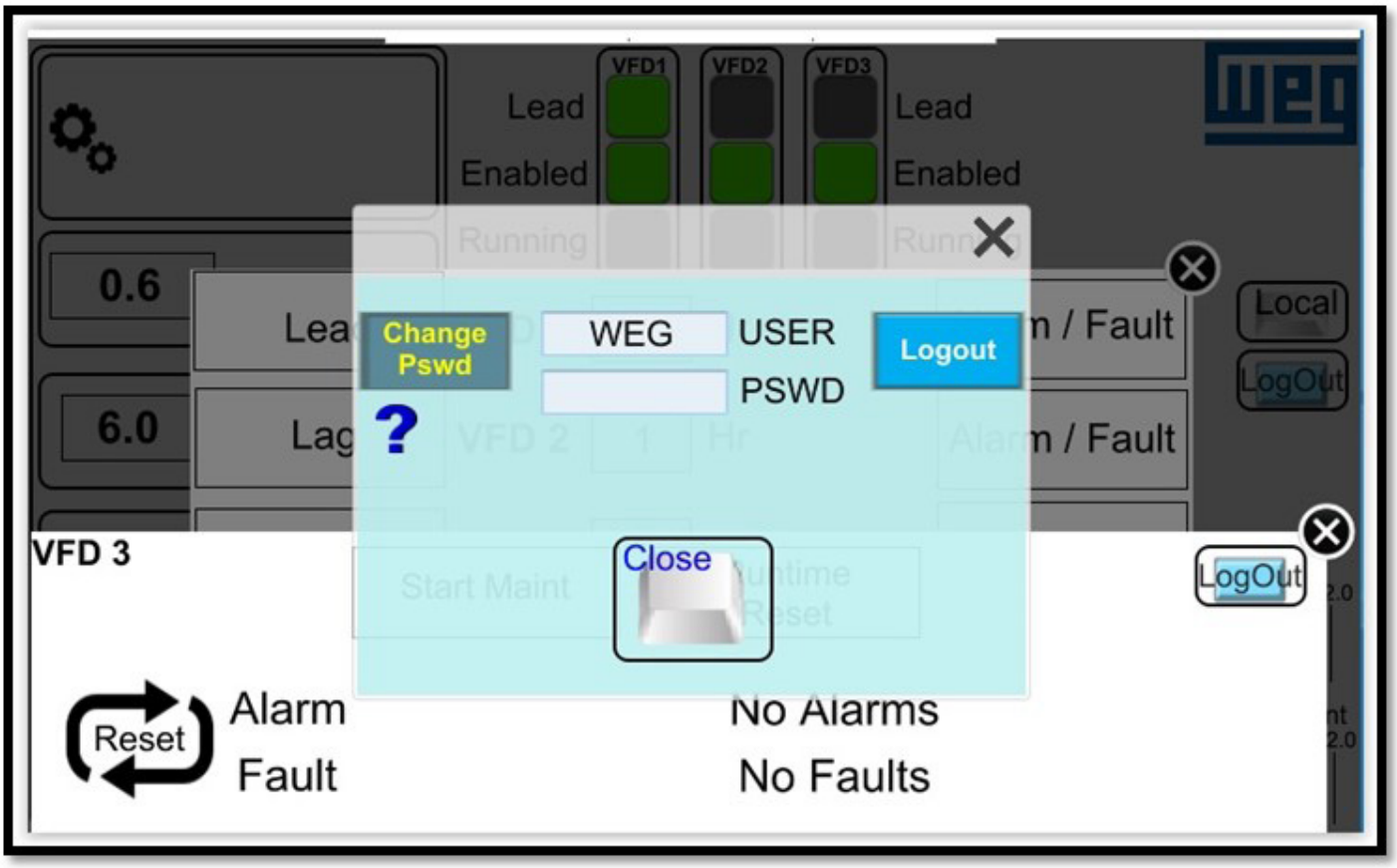

Figure 4: Login Popup

Selecting Login from any of the screens where the button is available, displays the pop-up shown in Figure 4. The **?** opens a help screen with detailed instructions on how to change the password.

After 5 minutes of no activity, a user is automatically logged out.

The initial login for the system is WEG/WEG.

All data subject to change without notice

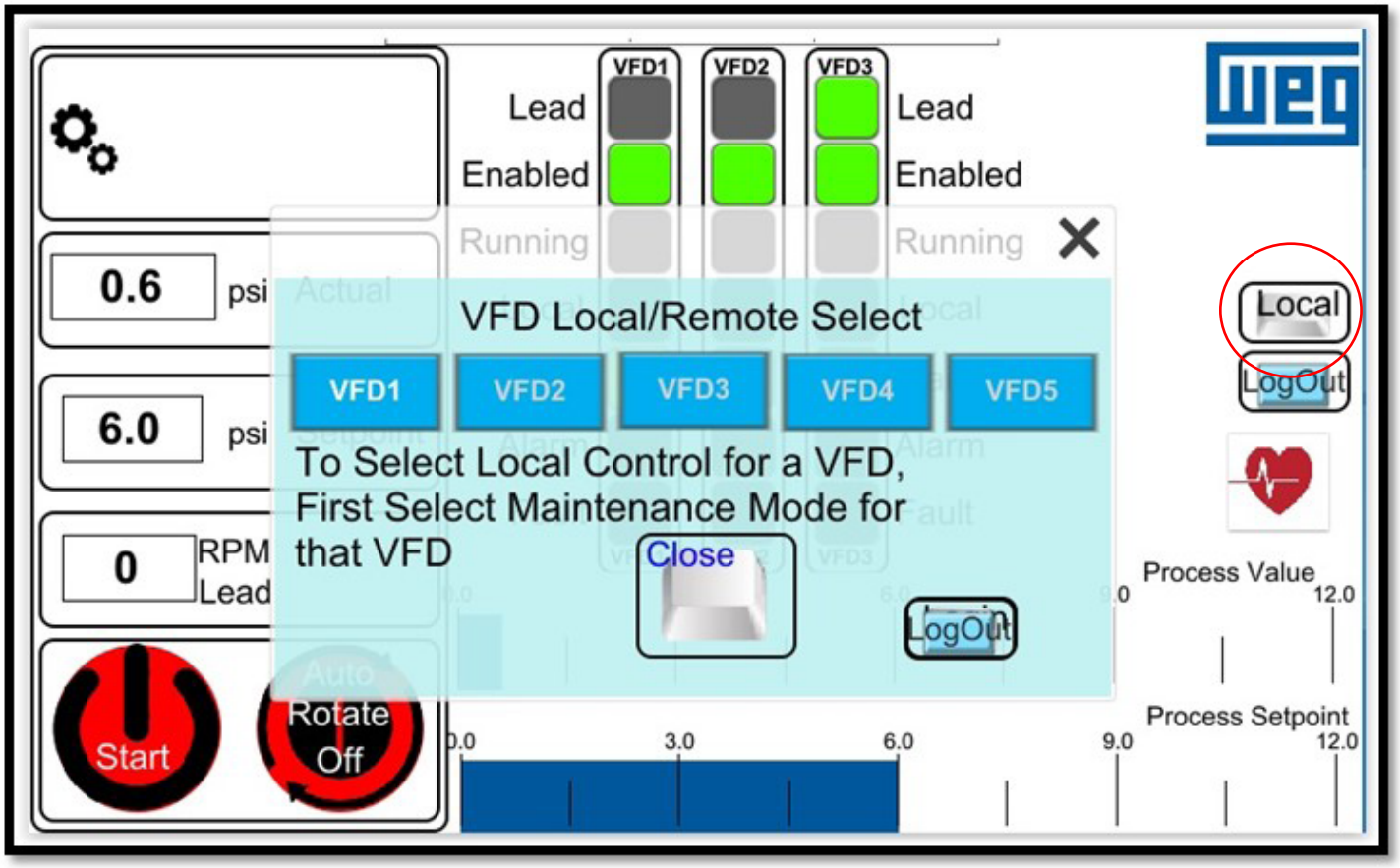

Figure 5: Local Control

Selecting the Local button allows changing a VFD control mode from Remote to Local. VFD1 is in maintenance in Figure 5 and can be changed to local control, i.e., the start/stop and speed reference are from the VFD keypad.

2.2. Wizards and Diagnostic Screens

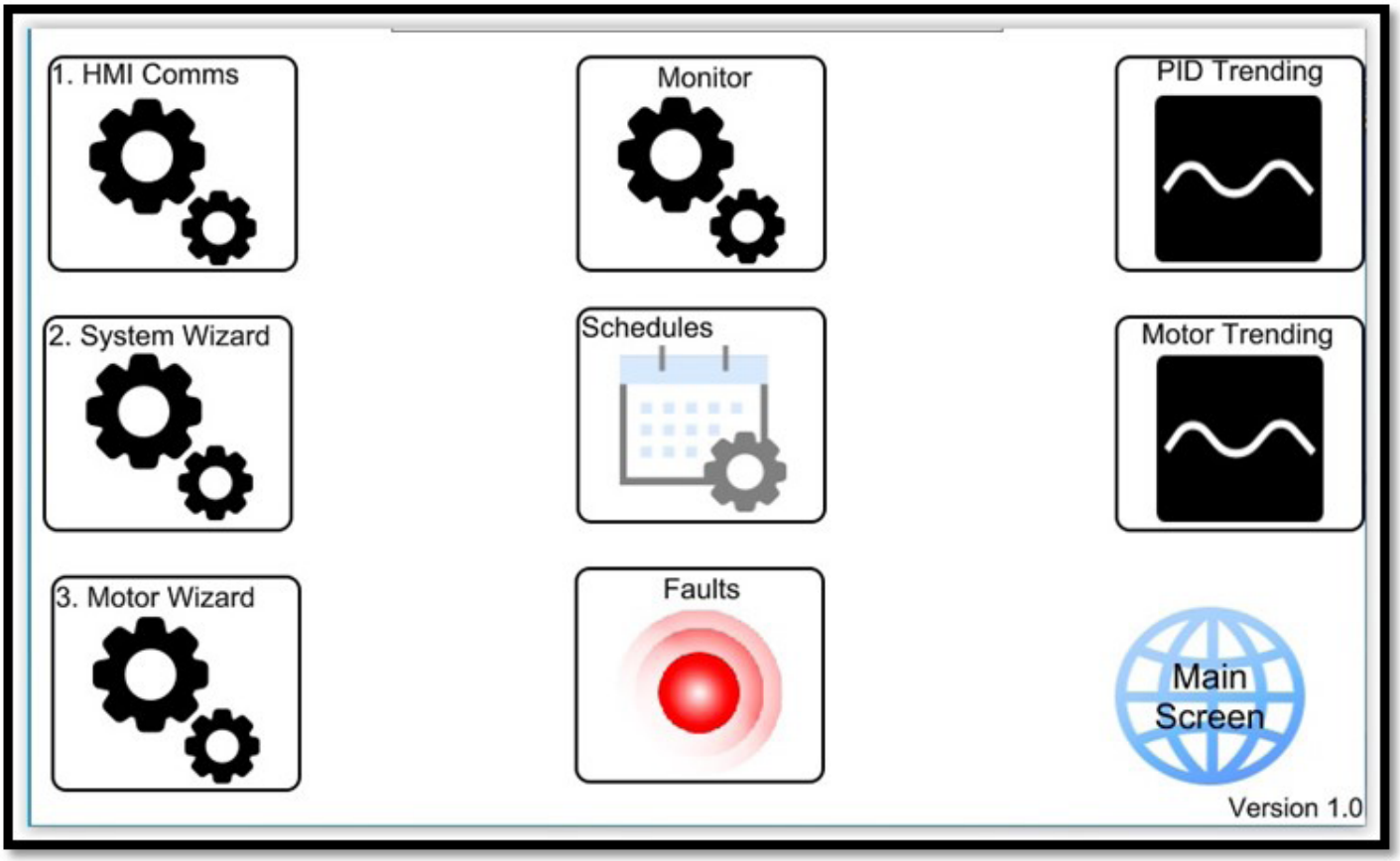

Figure 6: Wizards Screen

The Wizards Screen has links to the Motor Wizard, for setting the motor parameters, the System Wizard for setting the PG parameters, the HMI Com Wizard for setting the HMI communications as well as monitoring screens for the PID Trending and Motor Trending.

The numbering, 1-3, associated with the HMI Com, System Wizard and Motor Wizard suggests the order the Wizards should be run when commissioning a new system.

The Version in the bottom right hand corner of the screen is the Pump Genius software version.

2.2.1. Motor Wizard

The Motor Wizard is a series of screens used to configure the motor parameters and VFD parameters associated with motor performance, i.e., acceleration and deceleration ramps and minimum and maximum motor speeds. The option for loading and saving parameters can also be accessed through the Motor Wizard, refer to Figure 12.

To assure motor/VFD parameters are properly stored, changes should only be made when the VFDs/ motors are not running.

Figure 7 is the first screen displayed when the Motor Wizard is selected. The Left and Right arrow keys at the bottom of the screen are used for navigation to “previous” and “next” screens. Using the Right arrow keys on each screen will sequentially step a user through the screens shown in Figures 7 through 12.

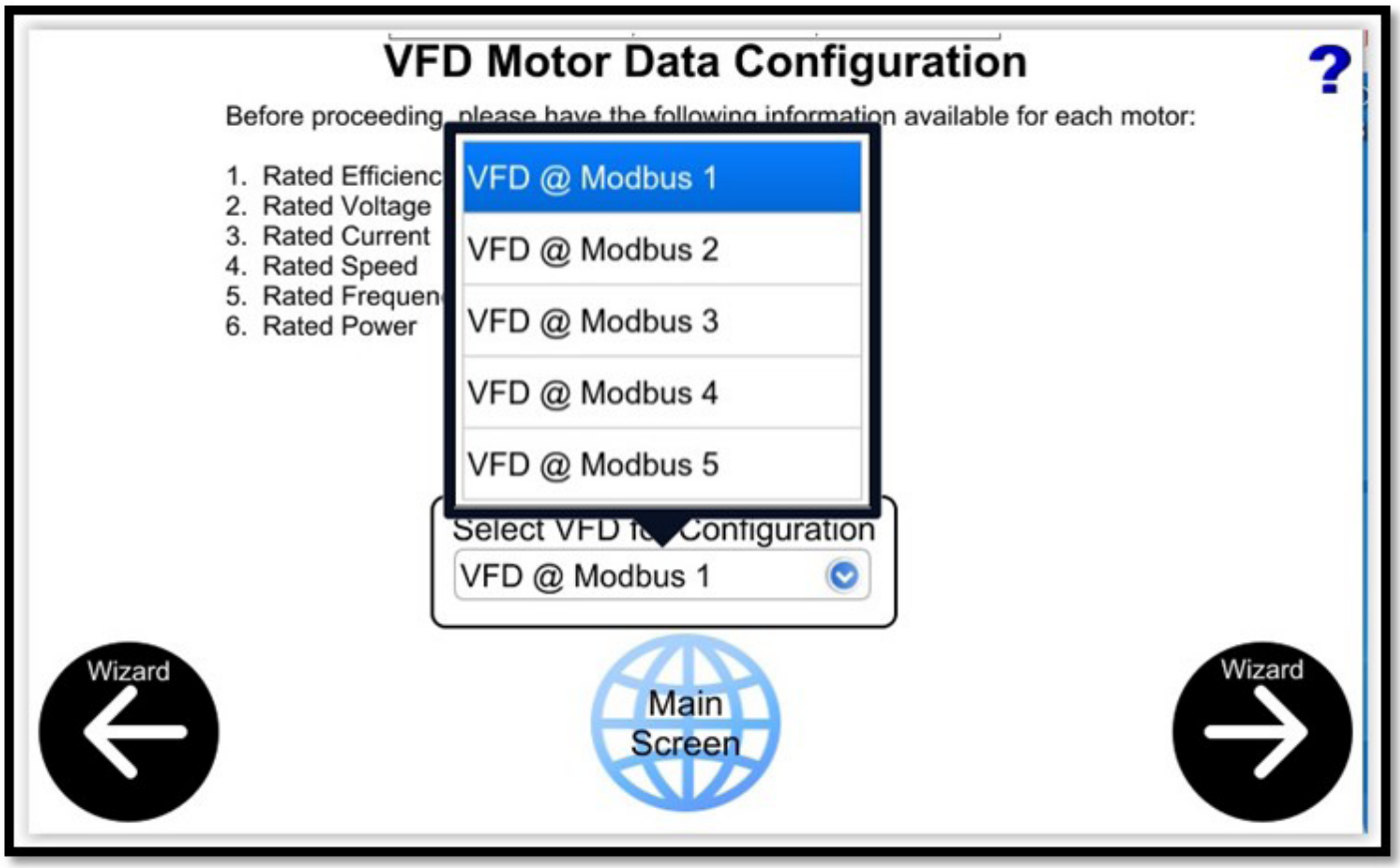

Figure 7: Motor Wizard Screen for VFD/Motor Selection

The **?** displayed on many of the screens opens a detailed help screen specific to that screen.

Five is the maximum number of VFDs the Pump Genius software will control.

Unless otherwise noted, values shown in the following screens are for illustrative purposes and values specific to an installation should be used when configuring a system.

Before proceeding to the screens shown in Figures 8 and 9, the recommendation is to have the motor name plate data available.

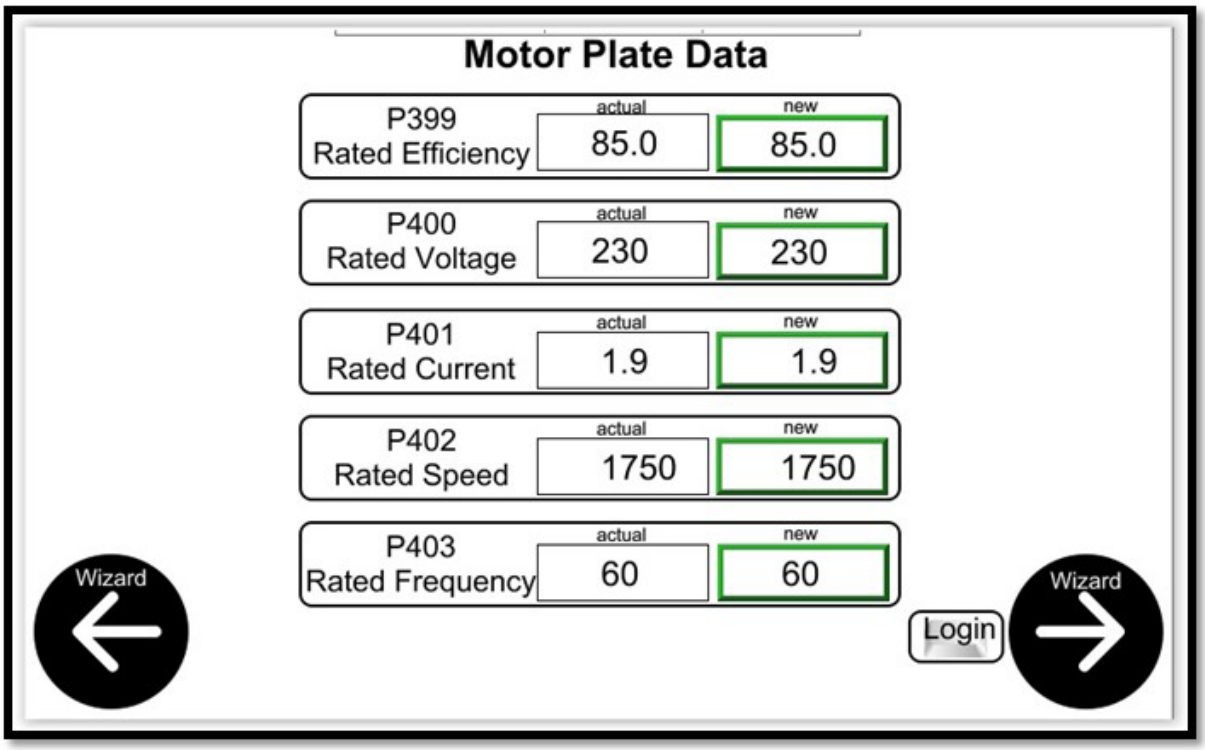

Figure 8: Motor Name Plate Data

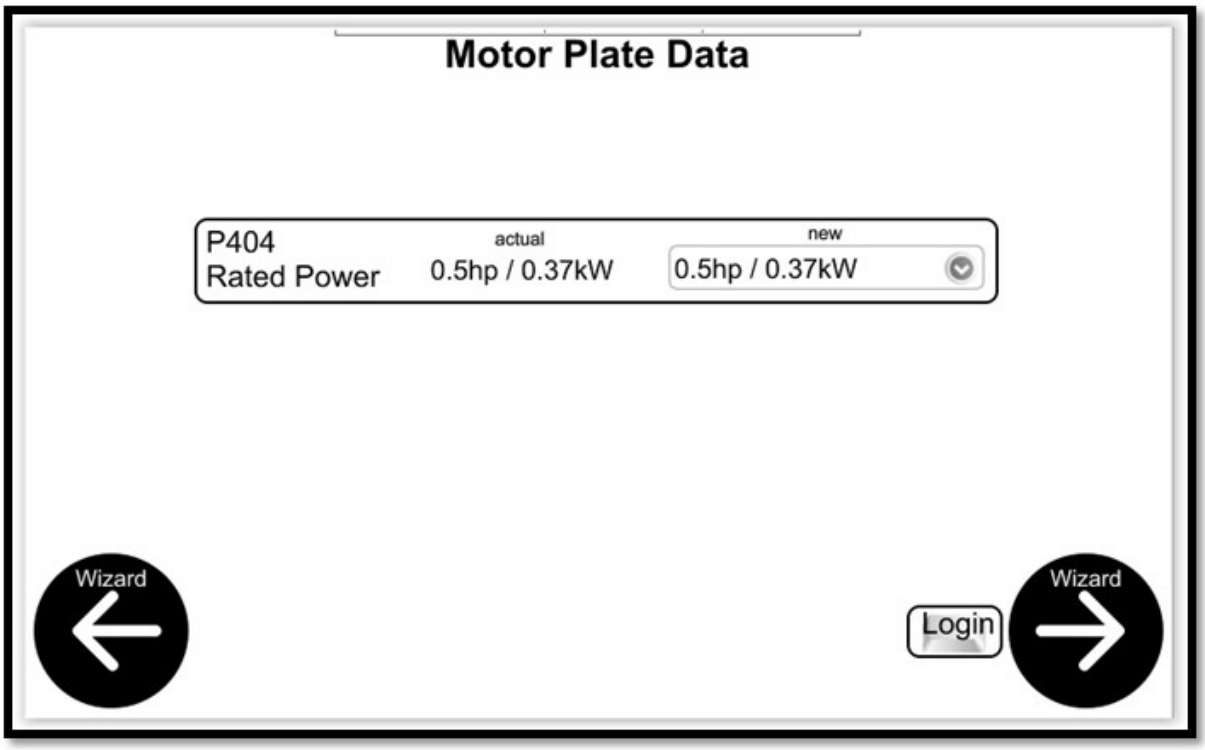

Figure 9: Motor Name Plate Data Continued

All data subject to change without notice

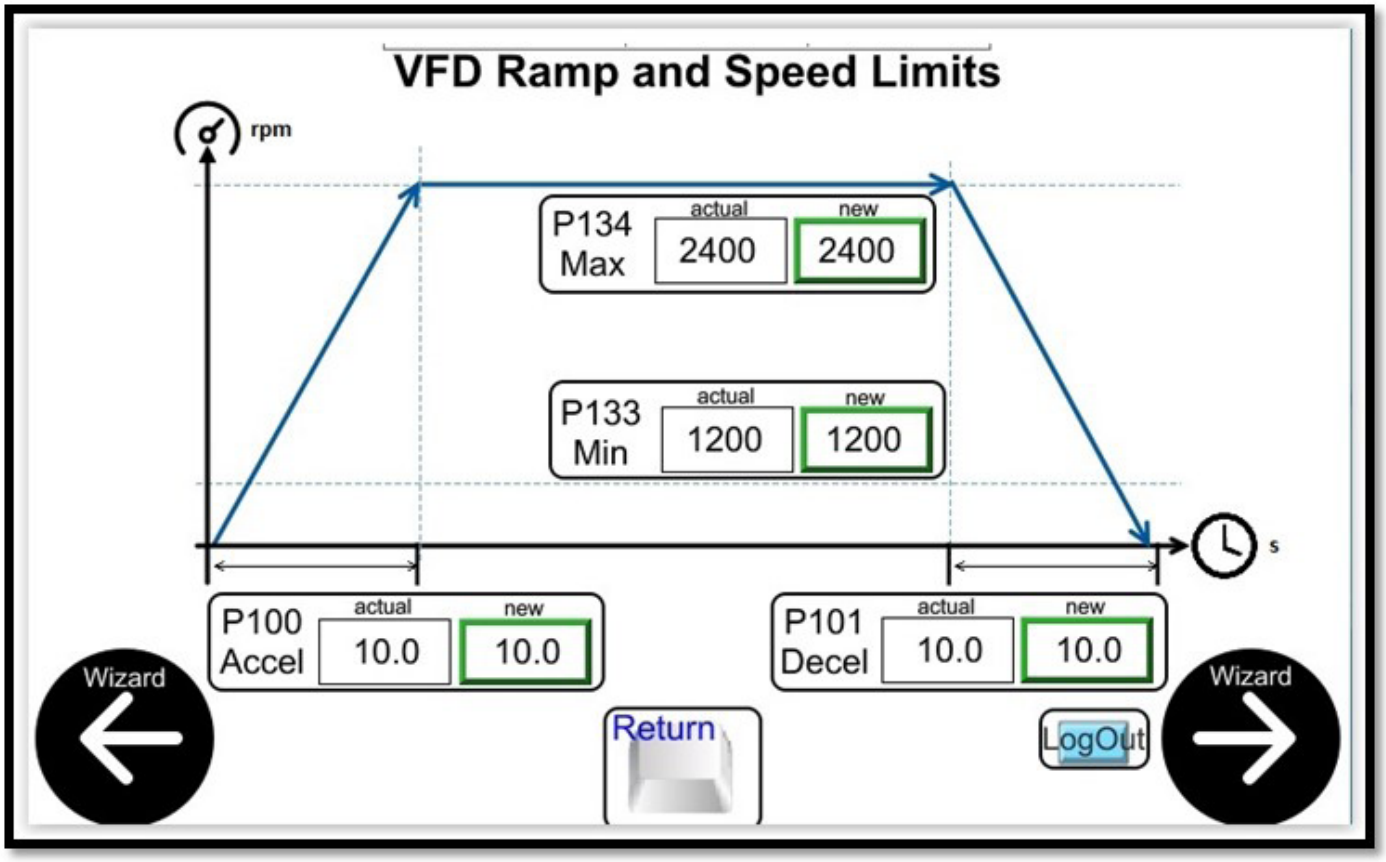

Figure 10: VFD Ramp and Motor Speed Limits

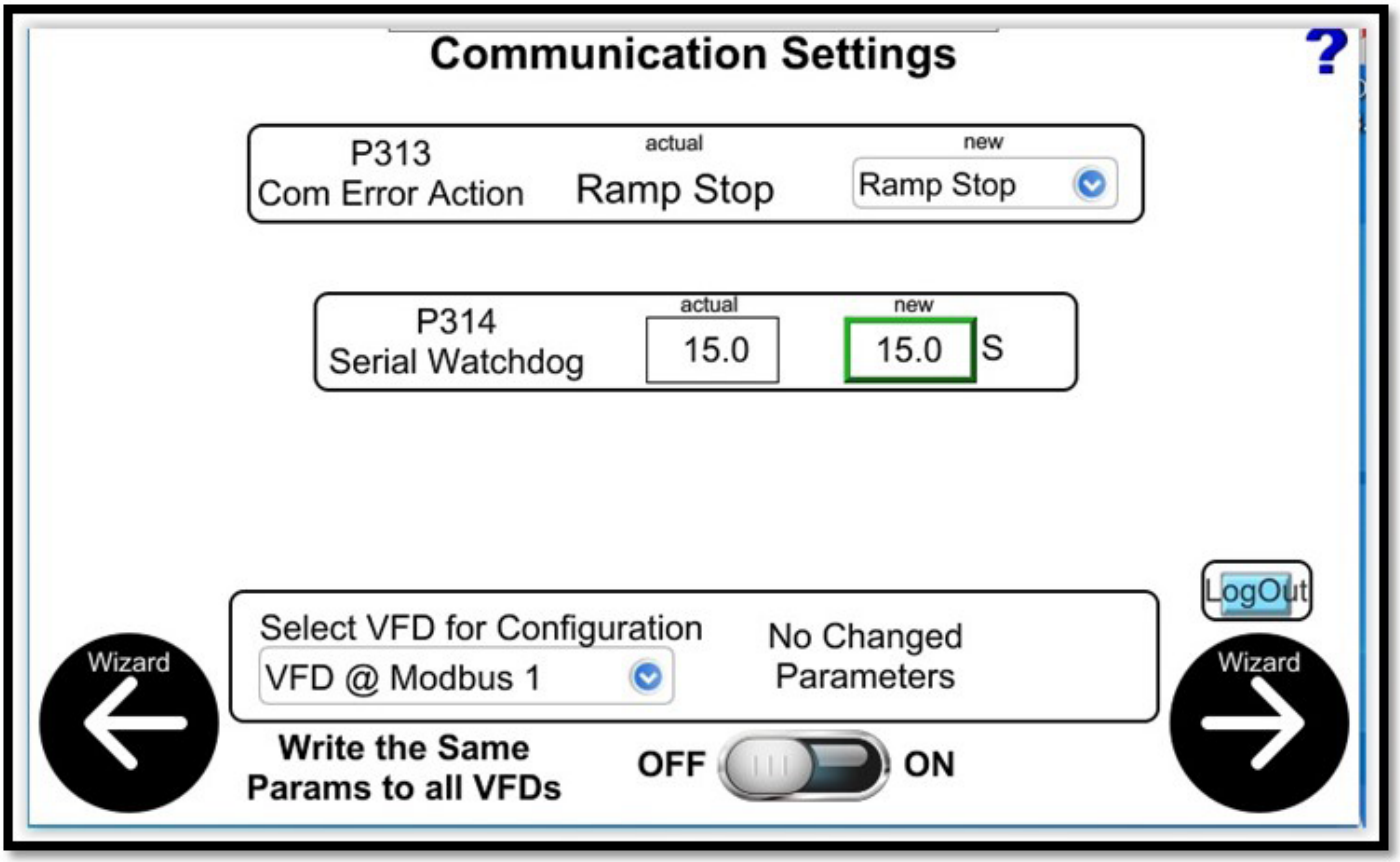

Figure 11: Communications Settings

This screen gives the option of writing the parameters to only one VFD, by Modbus address, or writing the same parameters to all of the VFDs in the system, if the motors/VFDs are identical.

Setting parameters 313 and 314 are very important for system operation. In the event the VFD(s) lose communications with the PLC/HMI, the VFDs should stop as they would no longer be controlled from the HMI/PLC and would continue to operate according to the last commands they received before losing communications. Fifteen (15) seconds is a recommended setting for parameter 314.

When the parameters are written to the VFD(s), programming in the HMI mimics the oriented startup, so a separate oriented startup is not required.

All data subject to change without notice

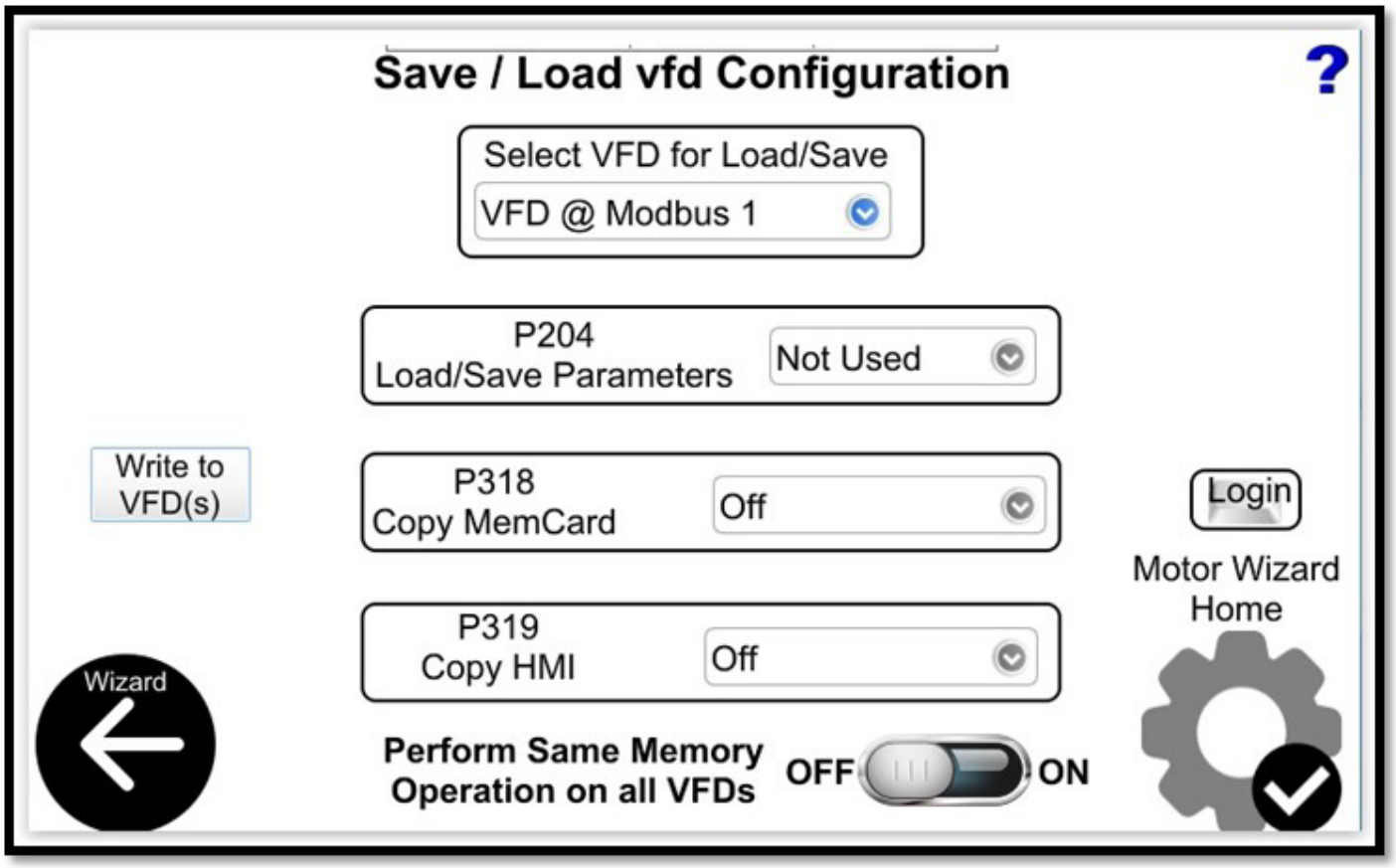

Figure 12: Load/Save Parameters

This screen gives the option of performing the operation(s) on only one VFD, by Modbus address, or on all of the VFDs in the system.

The icon at the bottom right, Settings Home, returns to the Wizards Screen, Figure 6.

The options available for saving/loading VFD configuration changes based on the model of VFD.

2.2.2. System Wizard

The System Wizard is a series of screens that configure how the PG operates. Each of the following setups is on its own System Wizard screen:

- Select the Number of VFDs in the System
- Select the model of VFDs, CFW11, CFW500 or CFW3X0 – Requires unique login
- Select Simplex System, which enabled Jockey Pump Configuration – Requires unique login
- Processor Sensor Setting
- PID Configuration
- Sleep Mode
- Sleep Mode Boost
- Pipe Charging
- Starting Additional VFDs
- Stopping Additional VFDs
- Forcing VFD Rotation
- Low- and High-Level Pump Protection
- Pump Protection Using an External Sensor, if not using VFD Analog Inputs
- Dry Pump Protection
- I/O Configuration, if not using VFD Analog Inputs
- Protection via Auxiliary sensor, if not using VFD Analog Inputs

Figure 13 is the first screen that opens when the System Wizard is selected. The selection shown in Figure 13 corresponds to the number of VFDs on the Main Screen shown in Figure 1.

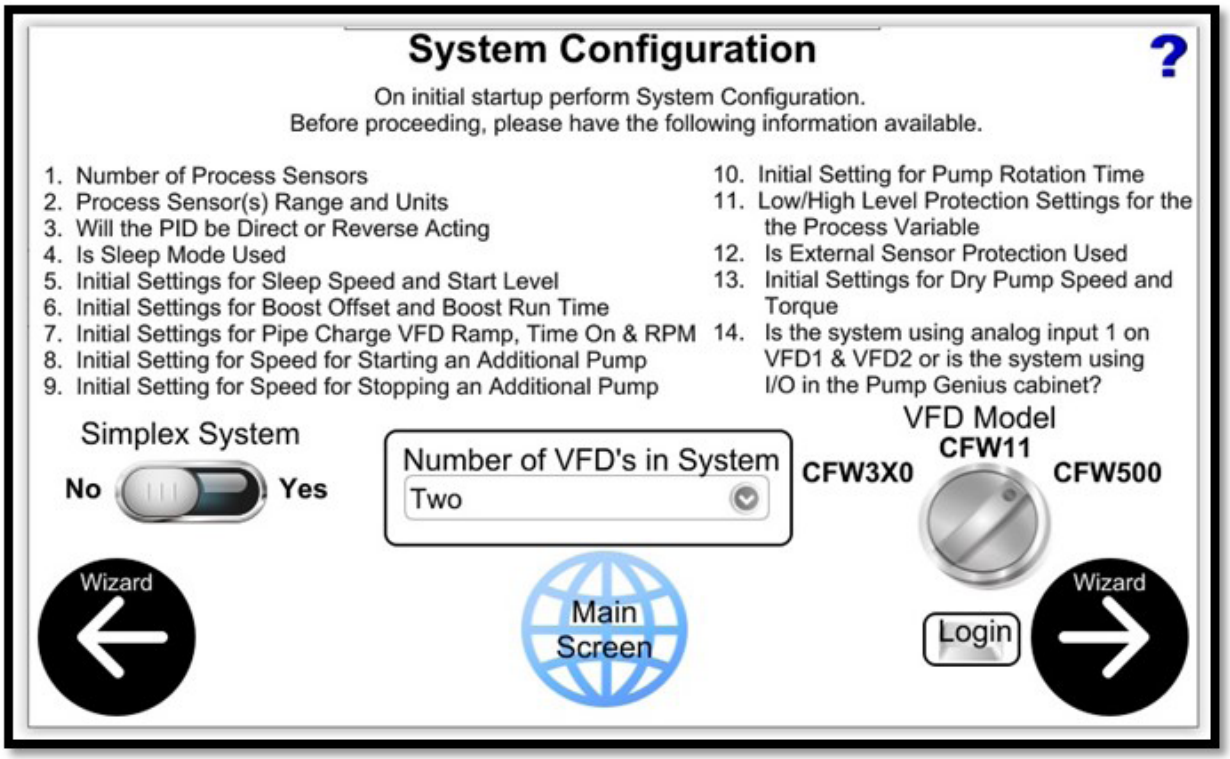

Figure 13: System Configuration

All data subject to change without notice

The Left and Right arrows on the bottom of the screens are used to navigate to the next/previous screen. Selecting the Right arrow key on the bottom of each screen will sequentially step a user through the screens shown in Figures 13 through 26.

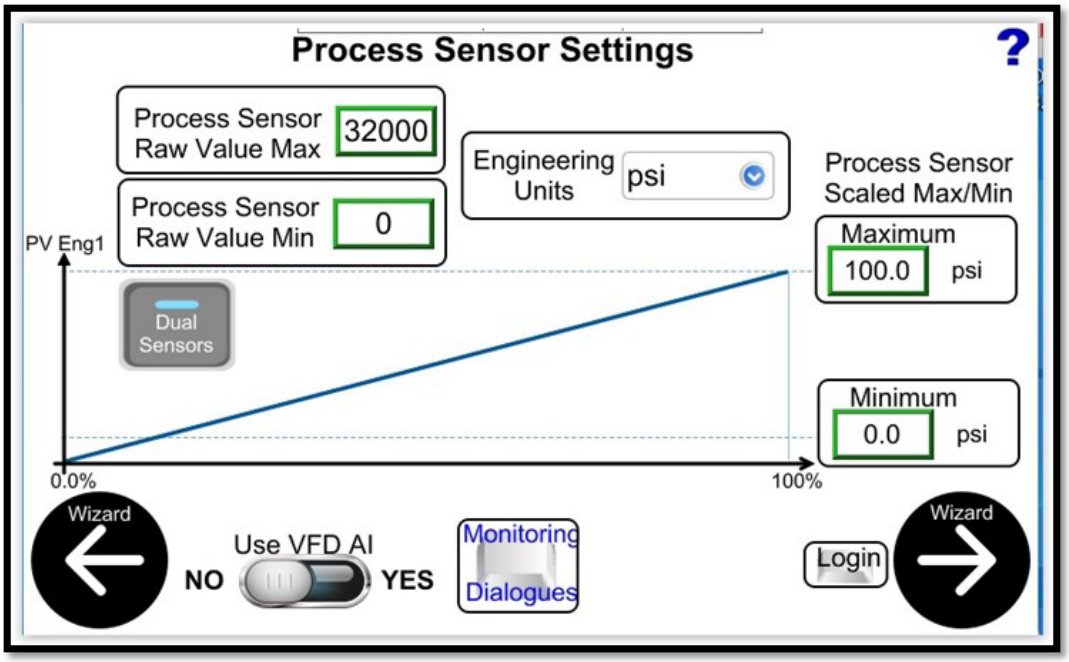

Figure 14: Process Sensor Settings

The process sensor raw values are the digital max/min expected from the analog input module the sensor is connected to. 0 to 32767 would be correct assuming the digital output from the analog module is a 16-bit signed integer. The default setting is 32000, the maximum digital value from the Weintek analog module.

The engineering units are selectable from this screen.

The process sensor scaled max/min is the range of the sensor, in the example shown, the pressure transmitter is 0-100psi.

Dual sensors would be selected if redundant process sensors are used in the system. The redundant process sensors could be AI1 on VFDs with Modbus addresses 1 and 2, or could be Analog inputs 1 and 2 of the I/O supplied in the Pump Genius control cabinet. The selection of the source for the process variable sensors depends on the position of the “Use VFD AI” switch. In the position shown in Figure 14, Analog Input 1 (AI1) on VFD1 and VFD2 provide the dual process sensors. Regardless of which source is chosen for dual sensors, the system will automatically fail over to sensor 2 if sensor 1 fails. If both sensors fail, the system will stop.

If the VFD(s) AI1 is used, parameters 231 and 233 are set by the program to “7” and “1” respectively and should not be changed (Note: for 4-20mA, the VFD DIP switches may need to be set appropriately, please refer to the VFD user manual). Parameters 232, 234 and 235 can be manually changed at the VFD keypad, if necessary (please refer to the VFD programming manual). If using the VFD(s) AI, the “Process Sensor Raw Value Max” should be changed to 32767.

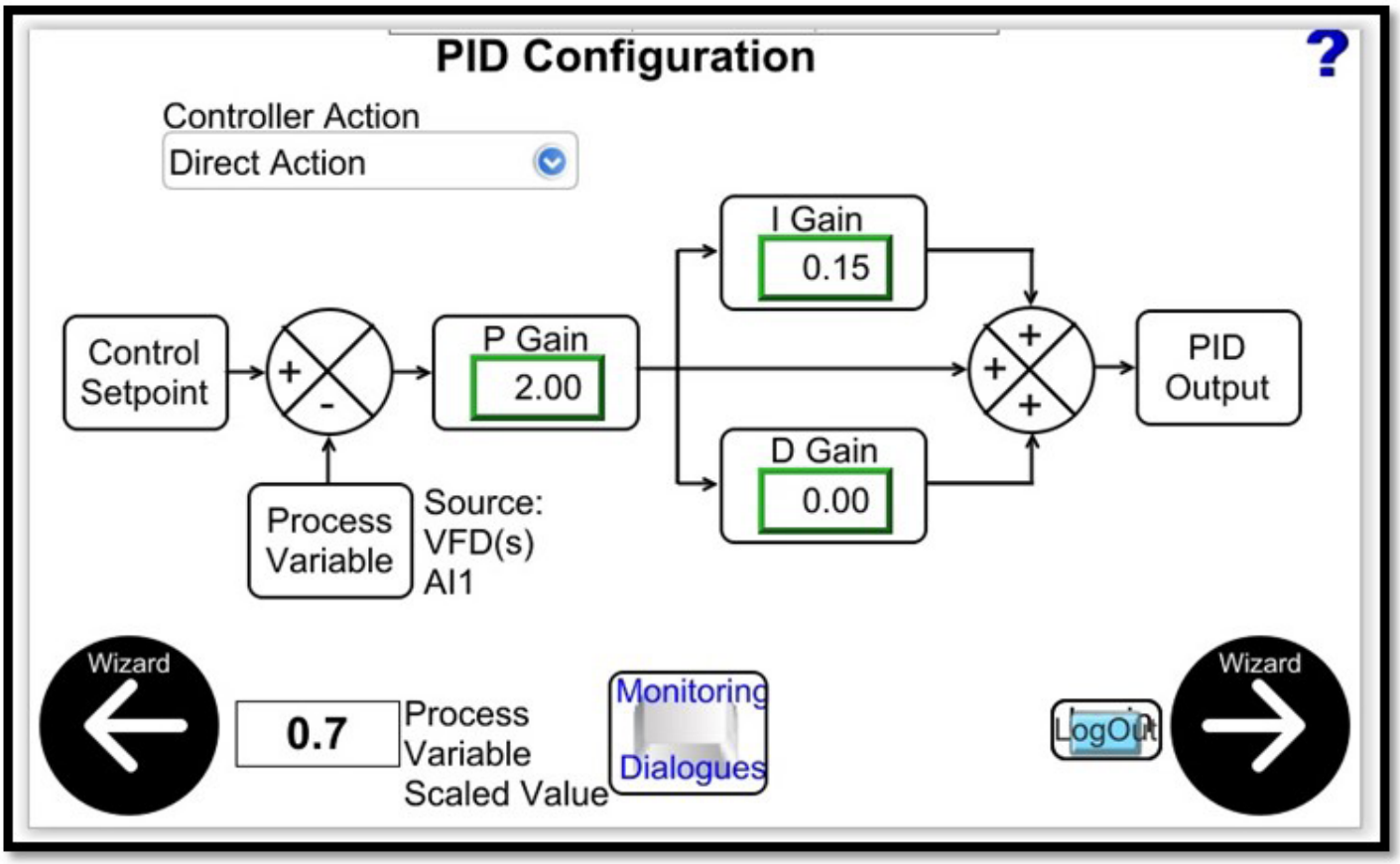

Figure 15: PID Configuration

The PID that controls the VFD(s) speed is in the CODESYS soft PLC.

The P, I and D gains shown in Figure 15, could be a good starting point for pressure control.

Suggested starting points for flow and level control:

- Flow – P Gain = 0.8; I Gain = 0.2; D Gain = 0
- Level – P Gain = 1.00; I Gain = 10.0; D Gain = 0

PID Gains may need to be adjusted from the suggested starting points for the actual process control.

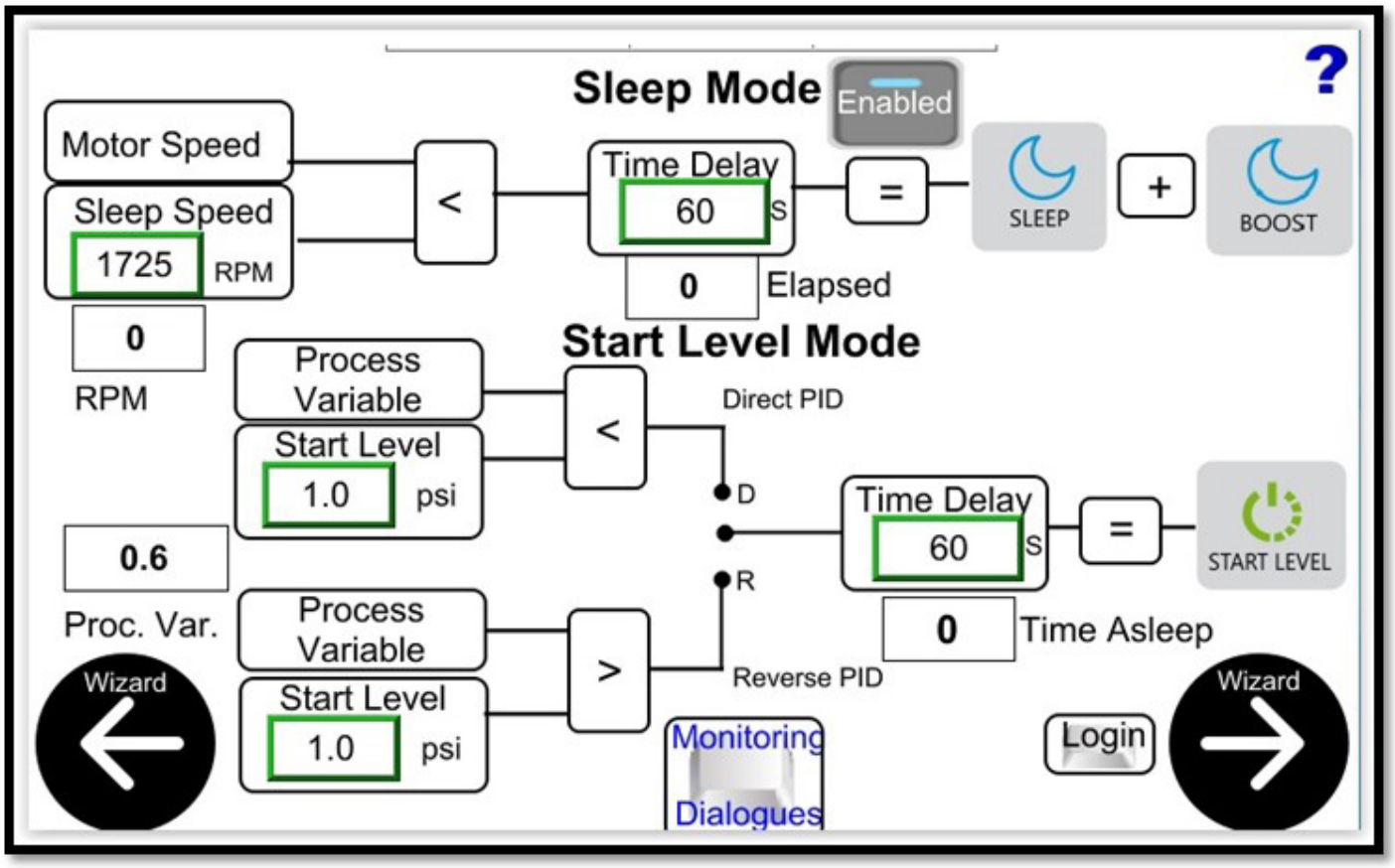

Figure 16: Sleep Mode Configuration

Sleep mode can be enabled/disabled from this screen, with the Enabled/Disabled button. If sleep mode is disabled, the settings on this screen have no effect and the VFD/pump will not go to sleep.

If sleep mode is enabled, the pump speed must be below the sleep speed for the time delay to initiate sleep mode. In sleep mode, the VFD is off, but the system shows started and sleeping.

To automatically end sleep mode, the process variable has to reach the appropriate level, either greater or less than the Start Level depending on whether the PID is direct or reverse acting, and the time delay has to expire. To manually exit sleep mode, the system must be stopped then started using the start/stop button on the main screen, Figure 1.

If the system goes into Sleep Mode, with one pump running, the force rotation timer is reset, refer to Figure 21.

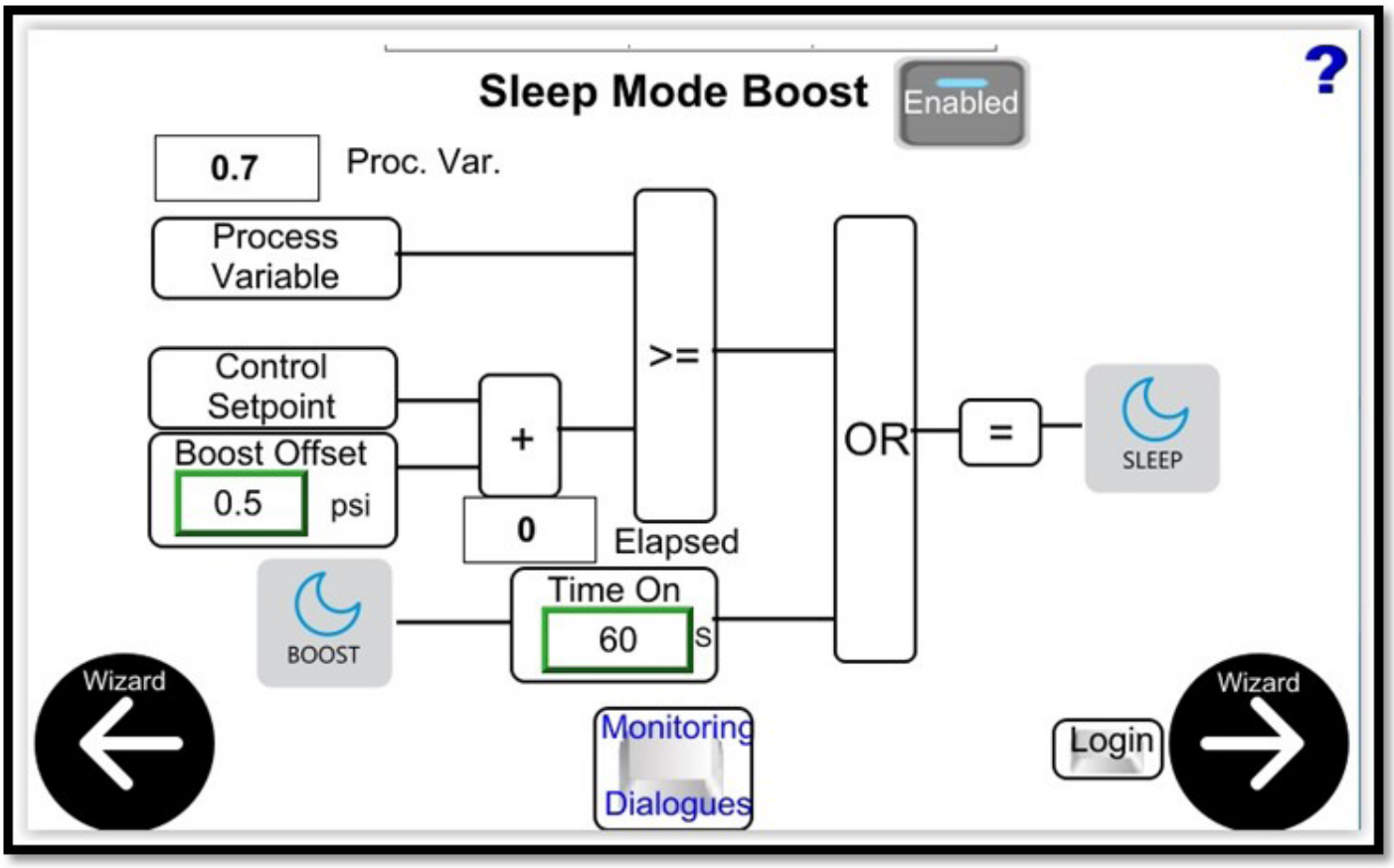

Figure 17: Sleep Mode Boost

If sleep mode is disabled, Figure 16, this screen is not displayed as part of the wizard.

If sleep mode is enabled, sleep boost can be separately enabled or disabled. If sleep boost is disabled, the system immediately goes to sleep when the sleep conditions are met. If sleep boost is enabled, the system first meets the boost conditions before going to sleep. For the boost period, the setpoint is changed by the Boost Offset. The system will try to meet the new boost setpoint up to the boost time on. Once the boost conditions, either setpoint or time are met, the system goes to sleep.

Wake up is the same, whether boost is enabled or not.

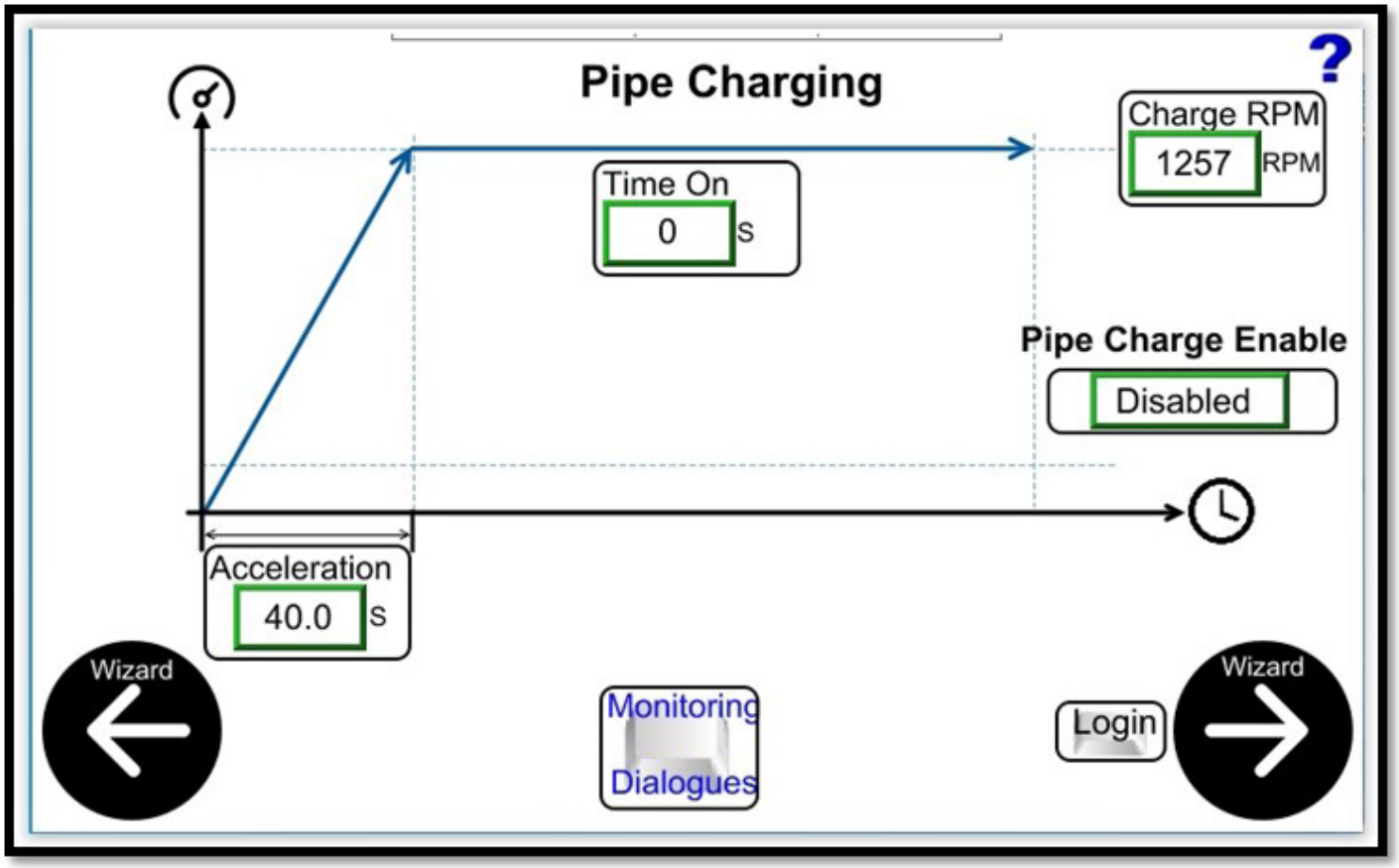

Figure 18: Pipe Charging

The total pipe charging time is the sum of the acceleration and time on.

The acceleration entered on the pipe charging screen is passed to the lead VFD, parameter 102, and is used as the VFD acceleration for pipe charging.

If no Charge RPM is entered, the minimum speed, Figure 10, is used for pipe charging.

The “Enabled/Disabled” toggle switch can be used to disable pipe charging on initial start. If pipe charging is disabled, the lead VFD will accelerate to the minimum speed, refer to Figure 10, and will hold at the minimum speed until the acceleration ramp time is done (note: not the acceleration ramp shown in Figure 18, but parameter 100, shown in Figure 10). The reason for holding until the acceleration ramp is complete is to avoid overshooting the setpoint on startup.

PG will start or stop additional pumps, based on running pump motor speed and the process variable, the goal is to run only the number of pumps necessary to maintain the process variable in a setpoint range.

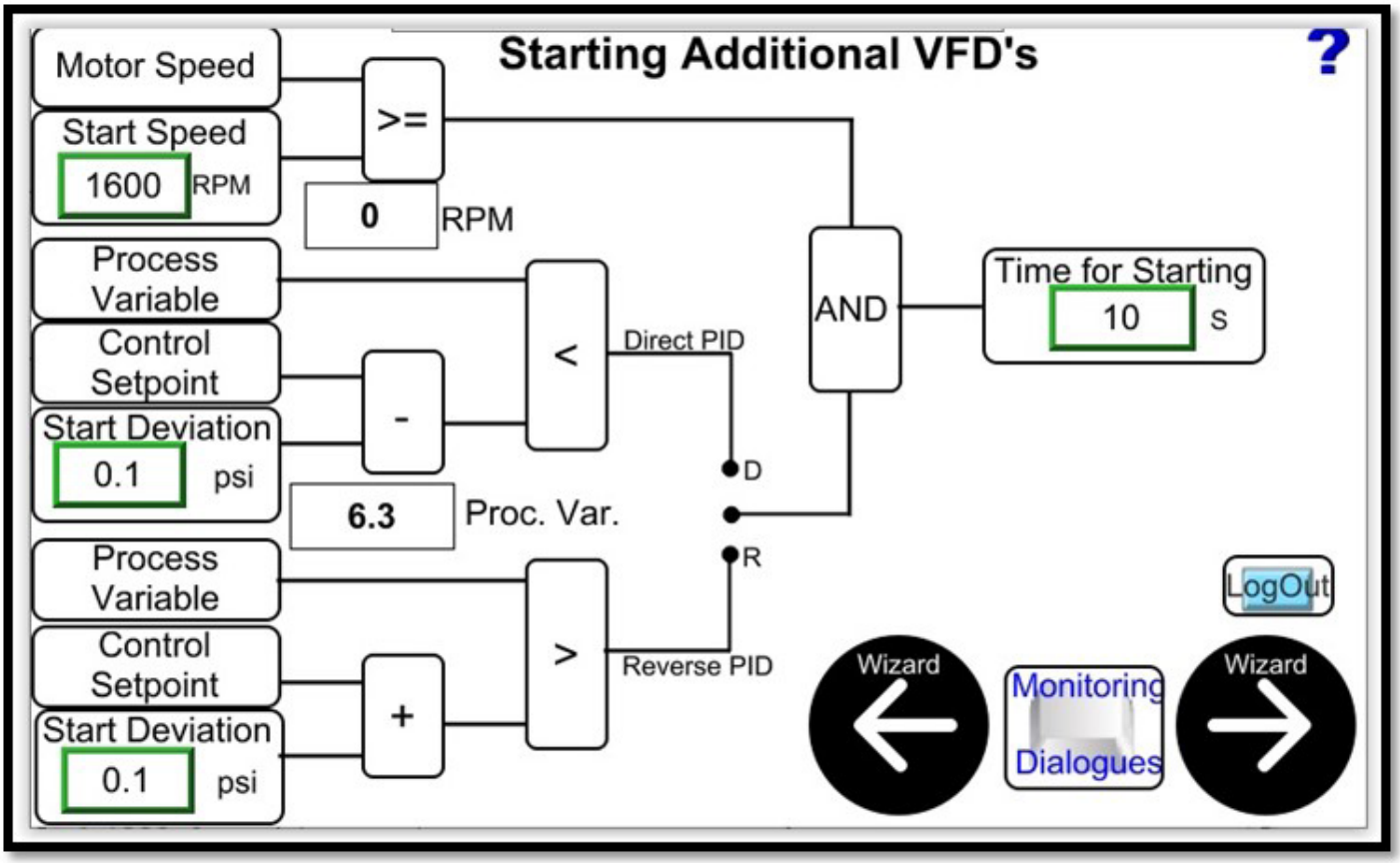

Figure 19: Starting Additional VFDs – Mulitplex Only

The conditions for starting an additional pump, illustrated in Figure 19 are: Running pump speed has to be greater than or equal to the user entered value, 2000rpm in this example; and if the PID is direct acting then the Process Variable has to be less than the Setpoint – (minus) 0.1 (user entered deviation of 0.1 psi in this example), or if the PID is reverse acting then the Process Variable has to be greater than the Setpoint + the deviation (user entered 0.1 psi in this example). The time delay for starting an additional pump, after the conditions are met, is entered by the user and in this example is 20 seconds.

When an additional pump is started for any reason, to avoid overshooting the setpoint, the PID is put in manual until the starting pump acceleration time (parameter 100) is finished. When the starting pump ramp time is finished, the PID is put into automatic. The reason for manipulating the PID control is to minimize overshoot.

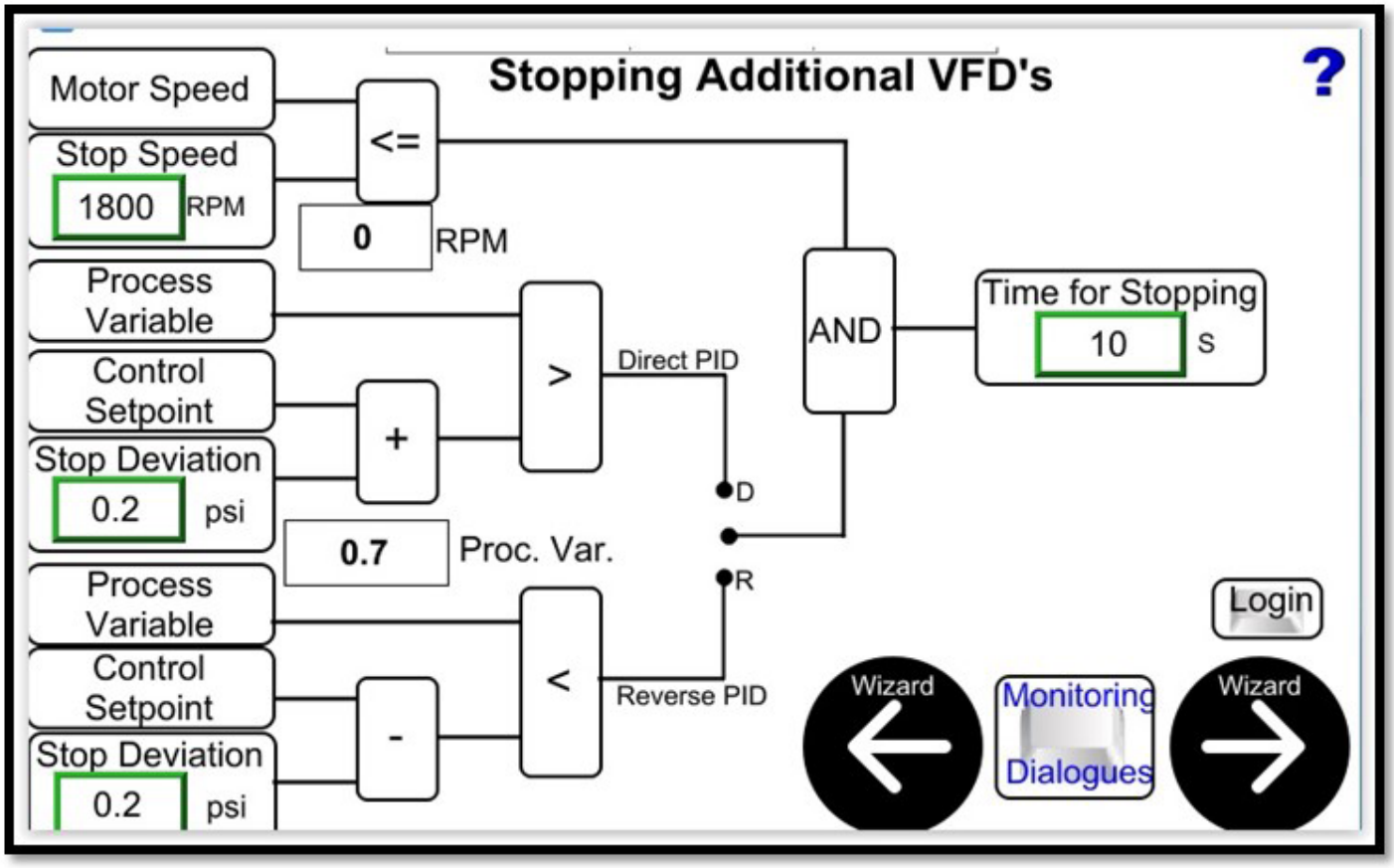

Figure 20: Stopping Additional VFDs – Mulitplex Only

The conditions for stopping an additional VFD are shown in Figure 20. The controlling motor speeds of the running pump(s) has to be less than or equal to the user entered Stop Speed: And if the PID is direct acting the Process Variable has to be greater than the Setpoint + the Stop Deviation (set by the user on this screen); Or if the PID is reverse acting, the Process Variable has to be less than the Setpoint – (minus) the Stop Deviation. The time the conditions have to be met before a pump is stopped is also set on this screen, and in this example is set to 10 seconds.

The Stop Deviation may not be applicable to all applications; however, it should never be set to zero. The default Stop Deviation is 0.2 engineering units.

PG has the ability, under user defined conditions, to force the rotation of the running pump.

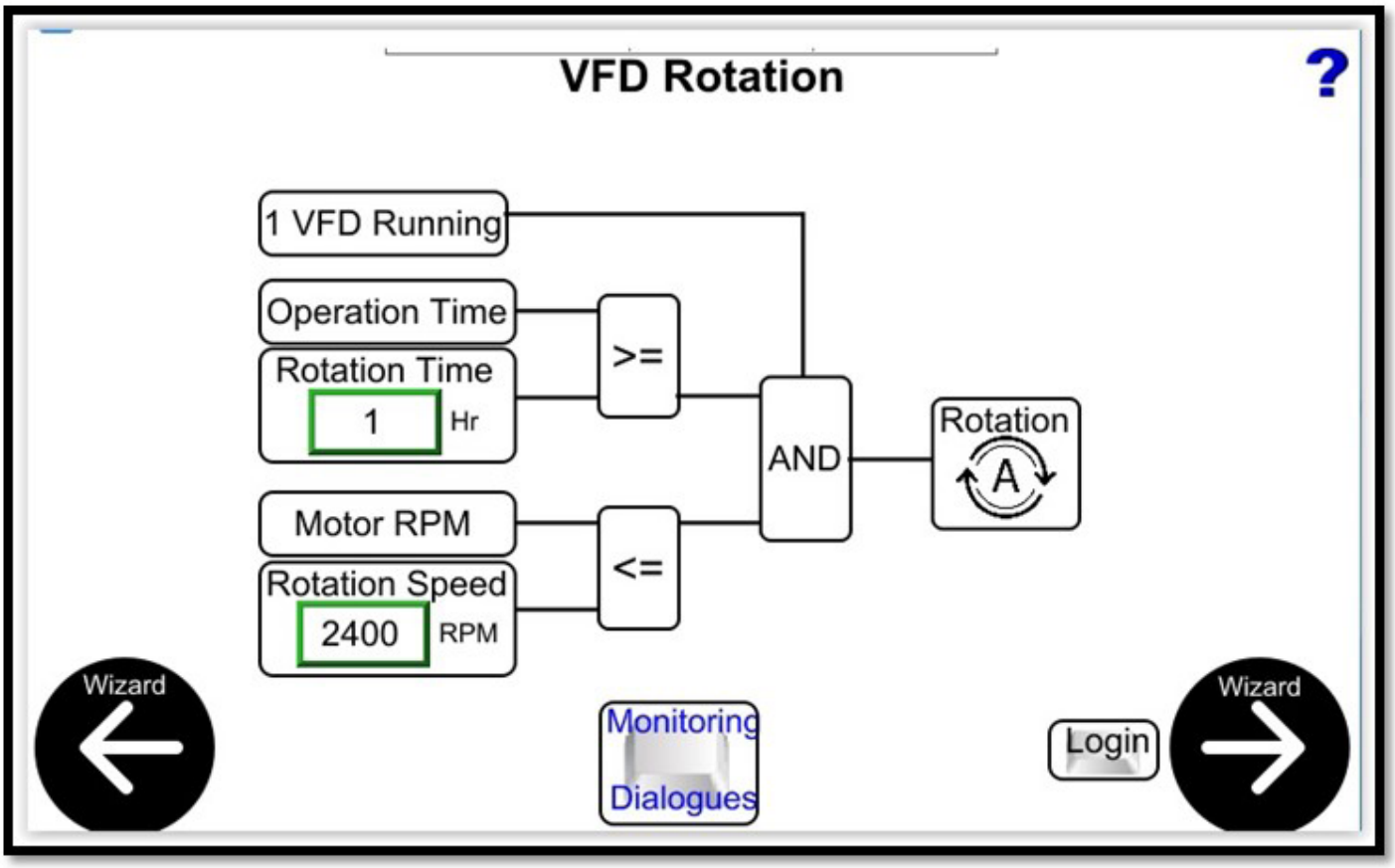

Figure 21: VFD Rotation Conditions – Multiplex Only

Only 1 VFD running is a condition that cannot be changed by the user to force the rotation of the running pump. Assuming only 1 VFD running, the user can configure the number of hours running standalone before a rotation is made, in this example, the Time is set to 1 hour. The user can also set a maximum speed for the running pump that will allow the rotation to take place, in this example, 2400 rpm. Given the conditions set in Figure 21, if only one pump has been running for a minimum of 1 hour and its current motor speed is at or below 2400 rpm, a forced rotation to an available VFD will take place.

If there are no pumps available for starting when the rotation time is reached, the one running pump continues to run and the rotation time resets and begins incrementing again.

Running a second VFD in local control, refer to Figure 5, resets the standalone running time, i.e., if one pump has been running standalone for 58 minutes and a second is started using local control, the running time for the standalone pump resets to zero.

If the 1 VFD running “goes to sleep”, the running time for that pump is reset. Refer to Figure 16 for Sleep Mode configuration.

All data subject to change without notice

If a Simplex system is configured, refer to Figure 13, the wizard screen that follows the Pipe Charging screen is the Jockey Pump configuration screen, Figure 22.

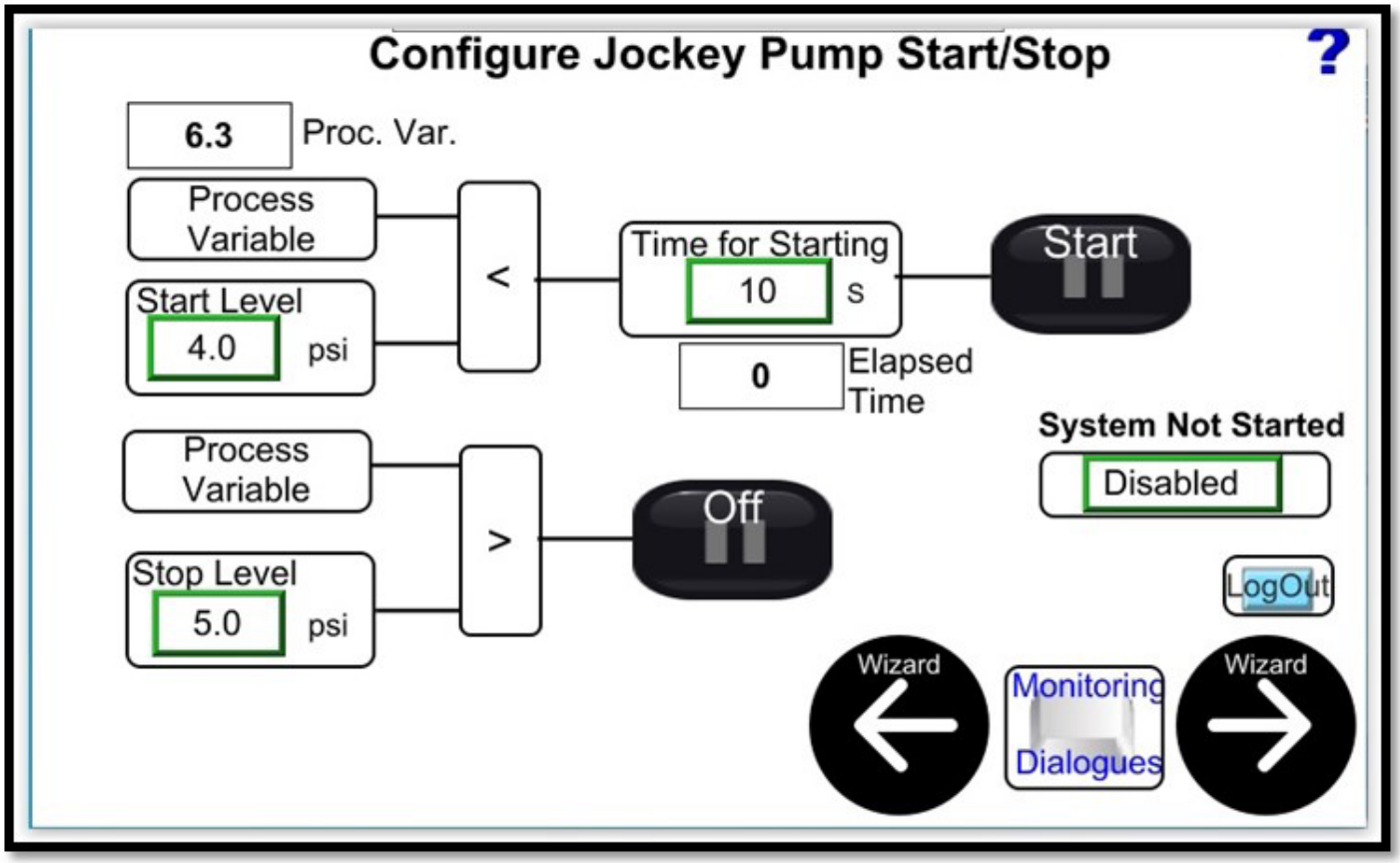

Figure 22: Jockey Pump Configuration - Simplex Only

If the Jockey Pump is enabled, it will only start if the system is started, using the Start Button shown on figure 1.

If the system is started and the Jockey Pump is enabled, the Jockey Pump will start/stop based on the Process Variable and the Start/Stop Level setpoints entered on the Configuration screen.

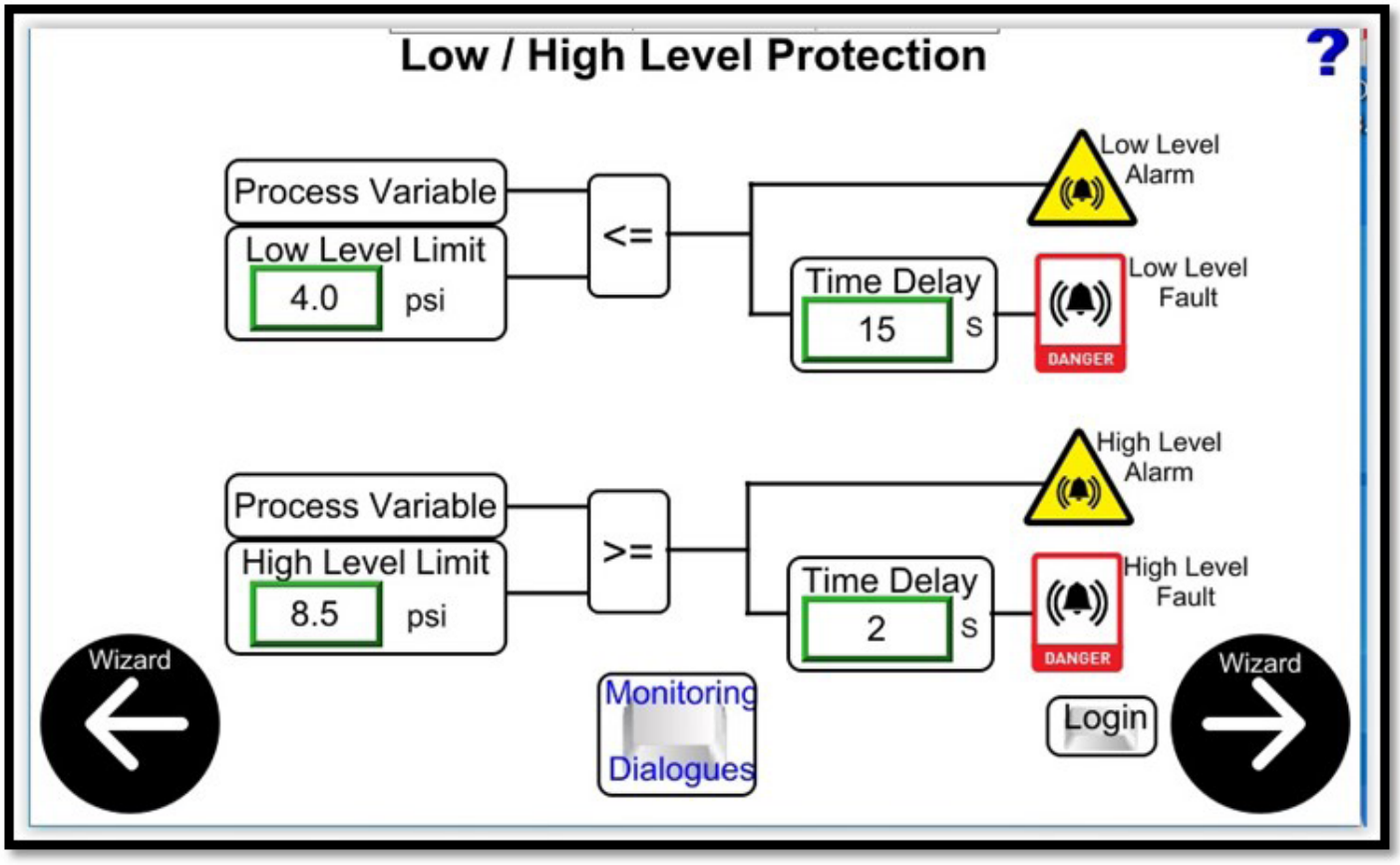

Figure 23: Low-High Level Protection

The user can configure Low- and High-Level limits on the Process Variable for system protection. The Low- and High-level limits are set in the engineering units selected in the Process Sensor Settings, Figure 14. When the user configured Process Variable Limit is exceeded, an appropriate alarm, Low or High level is generated. If the user configures a Time Delay, after the alarm has been present for the Time Delay, the appropriate Fault, low or high is activated and the VFD(s) stop on the fault.

An external, discrete sensor, can be wired to an Input and enabled or disabled as needed to provide additional system protection.

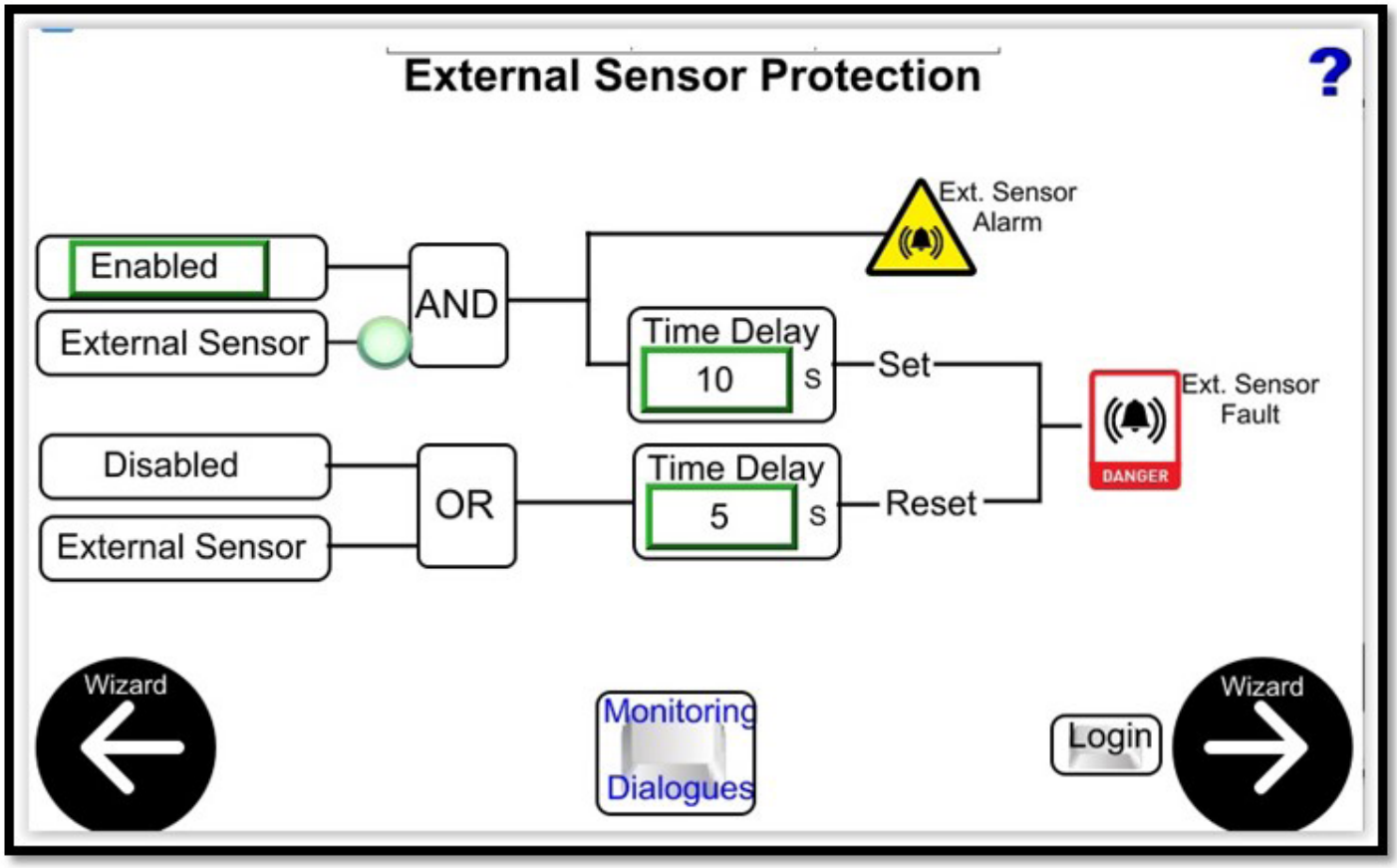

Figure 24: External Sensor Protection

If the External Sensor is Enabled and the input is not on an External Sensor Alarm is generated. After the Time Delay, if the input is still off, an External Sensor Fault is generated and the VFD(s) stop on the fault. If the sensor input comes back on, or the sensor is disabled, the fault will reset after the Reset Time Delay; however, the system will not automatically restart.

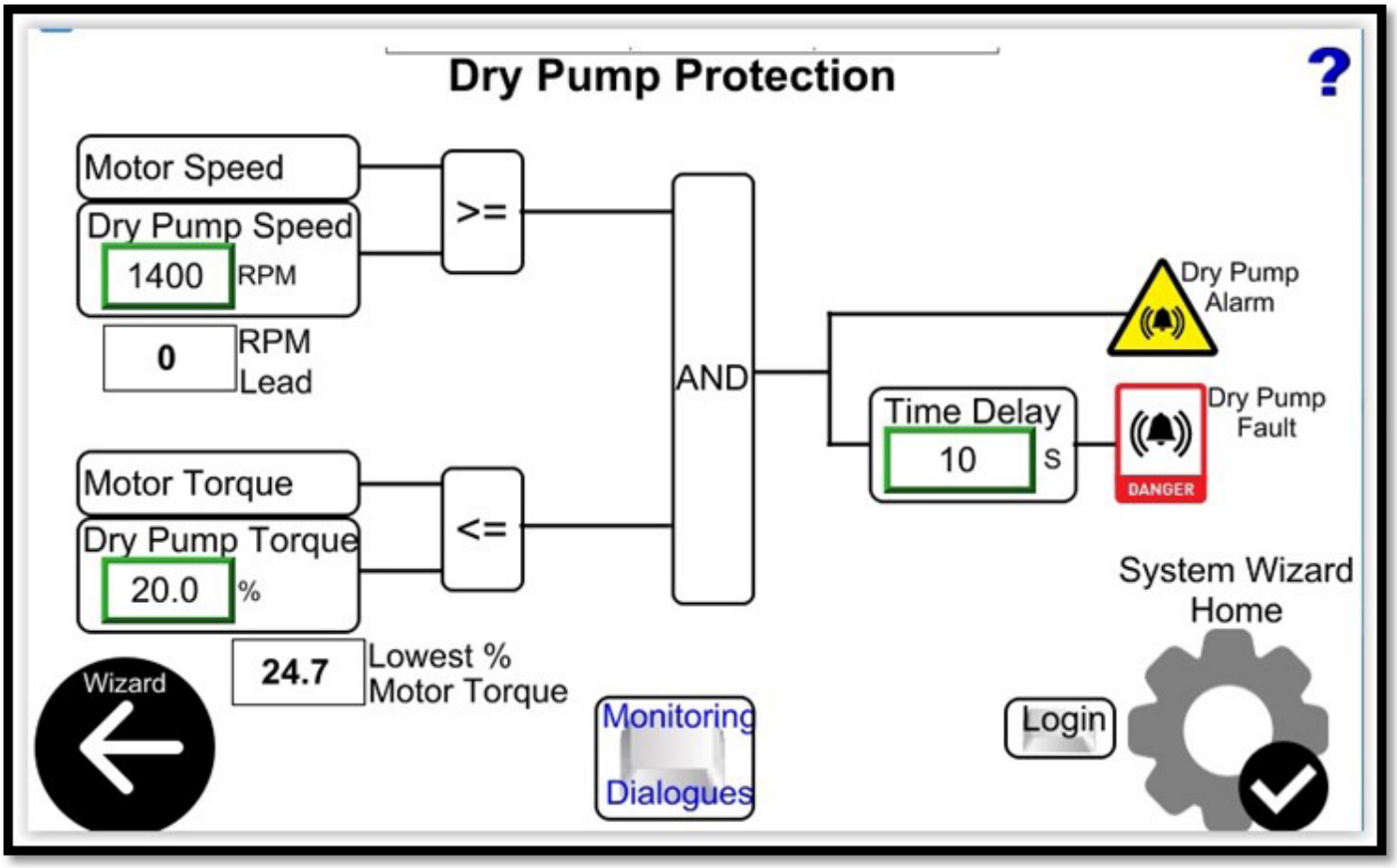

Figure 25: Dry Pump Protection

The dry pump protection monitors the motor torque of all running VFD(s) and will shutdown the VFD(s) based on a user defined Dry Pump Torque, at a user specified rpm, after the Time Delay.

If the VFD(s) analog input 1 is used for the process variable, refer to Figure 14, Dry Pump Protection is the final screen in the system wizard.

All data subject to change without notice

If I/O in the PG control cabinet is used, two additional screens are available in the system configuration wizard for configuring the discrete and analog I/O.

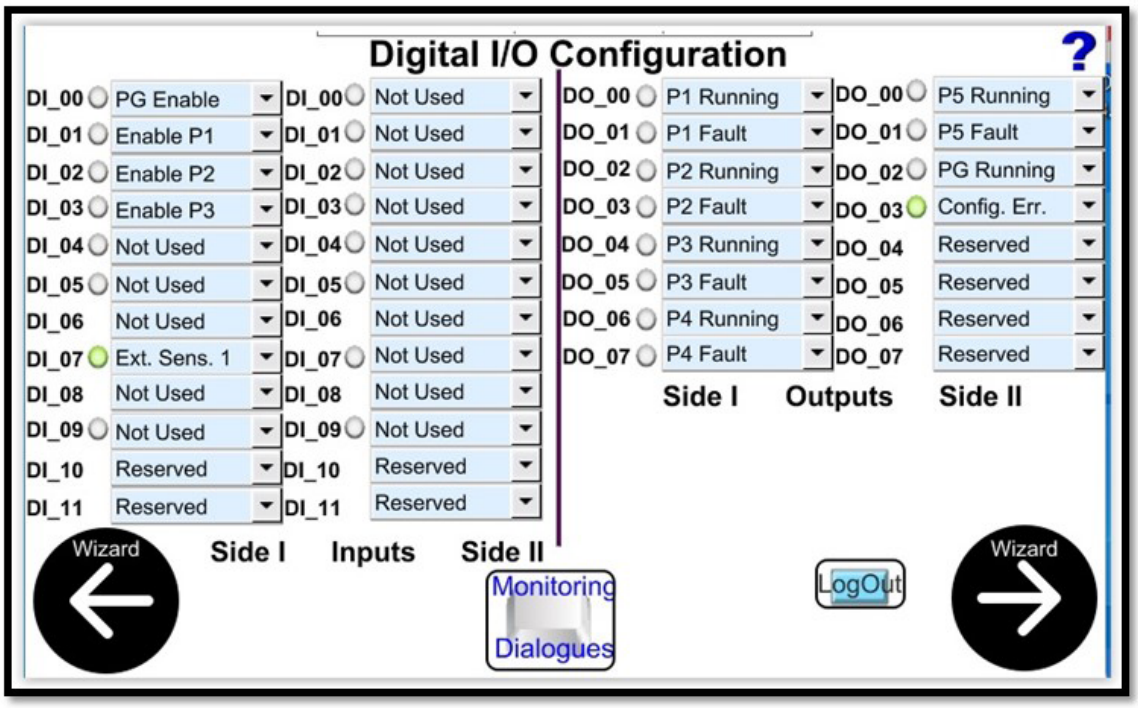

Figure 26: Digital I/O Configuration

The digital inputs are arranged so Side II could mirror Side I. Side II inputs could also be used for external PG enable or individual pump enable switches.

PG Enable is selected for DI_00, and the input is not on disabling the start/stop button on the Main Screen, refer to Figure 1. If the system was running when the PG Enable input was lost, the system will stop and cannot be restarted until the PG Enable signal is restored, or the function is changed to “Not Used”.

“Enable_Px” enables automatic control of the VFD through the Pump Genius software. The Enable input is not used as a VFD enable, so for example if “Enable_P1” is selected for DI_02 and the input is off, the VFD could still be run from the VFD keypad if the VFD is put in local, refer to Figure 5. If “Not Used” is selected for a Pump Enable input, the Pump Genius software will attempt to control the VFD whether the corresponding input is on or not.

The discrete outputs can be used for indication on the PG control cabinet, or customer supplied indication at the pump. Each output should be limited to 1 Amp maximum, if remote indication at a pump is used.

The “Dot” beside each point indicates the state of the I/O, green is on and gray is off. If there is no “Dot” it indicates the I/O point does not have a function in PG. Reserved indicates the I/O point is available for the high speed counter module built into the Weintek I/O – the high speed counters are not used in PG.

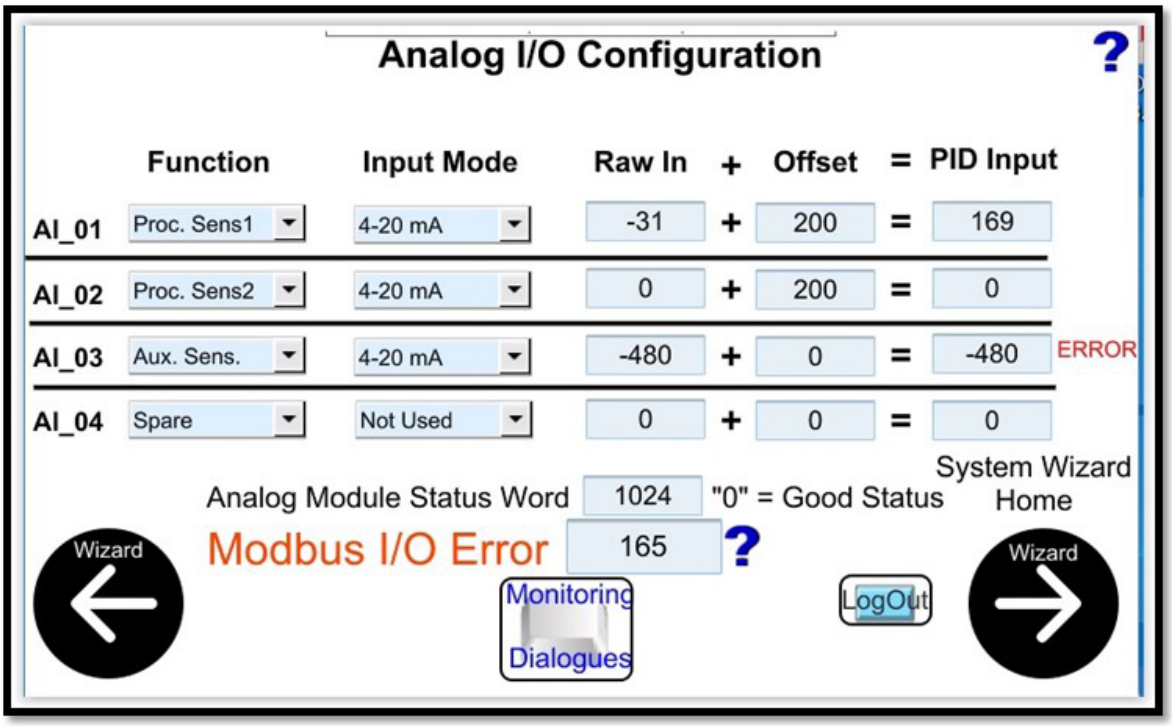

Figure 27: Analog I/O Configuration

Three analog inputs are used by PG. Inputs 1 and 2 are the process sensors, input 2 is only used if dual sensors is selected, refer to Figure 14. The Offset can be used to zero out any DC offset present.

The error indication for AI_03 is because 4-20mA is selected as the signal type and the wires from the sensor are open. The "**ERROR**" indication corresponds to the Analog Module Status Word of 1024. An Analog Status Word of 256 would indicate an error with channel 1, a value of 512 would indicate an error with channel 2. A value of 2048 would indicate a problem with channel 4; however, channel 4 is not used in PG. The error indicated for channel 3 would disable the use of the auxiliary variable.

The "**Modbus I/O Error**" would also appear on the Digital I/O Configuration screen, Figure 25. Selecting the question mark beside the I/O Error number displays the list of error codes shown in Figure 27. A Modbus I/O Error prevents the system from running.

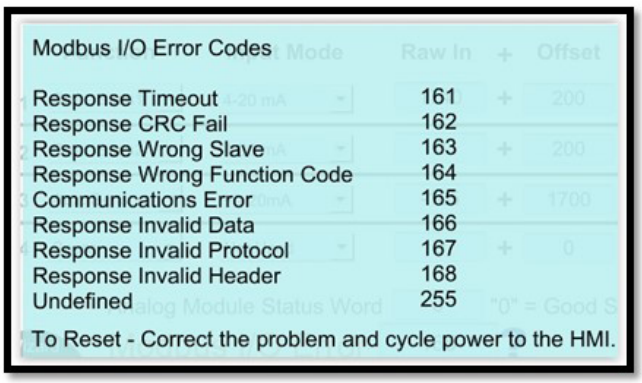

Figure 28: Modbus I/O Error Codes

All data subject to change without notice

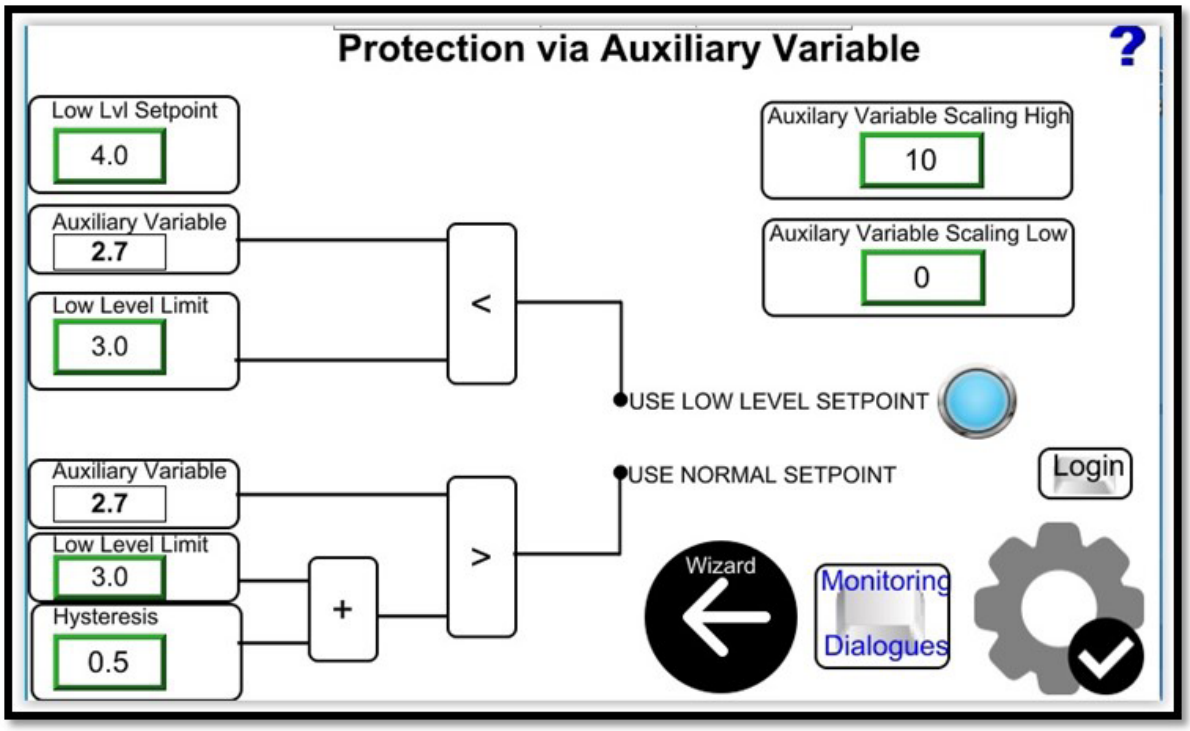

Figure 29: Protection via Auxiliary Variable

The Protection via Auxiliary Variable screen is only available if Aux_Sens. Is selected for analog input 3, refer to Figure 26.

The purpose of the auxiliary variable is to automatically reduce the system setpoint based on the input from the auxiliary sensor.

Low Lvl Setpoint is used if the condition is met, i.e., the scaled input from the auxiliary variable is less than the Low Level Limit. The “light” to the right of text “USE LOW LEVEL SETPOINT” is illuminated when the condition for using the alternate setpoint is met.

Hysteresis is generally a relatively small value added to the low level limit to prevent premature switching between the user entered setpoint and the auxiliary setpoint.

Auxiliary Variable Scaling High and Low are the range of the transmitter used, in Figure 27, the range of the transmitter is 0-10. The auxiliary variable is dimensionless, which does not affect operation, as long as the range of the transmitter is entered properly.

There is an alarm created in the Alarms table to indicate auxiliary variable protection is active.

There is also an indication on the main screen:

2.2.3. Monitor

The monitor screen provides the opportunity to access individual screens in the System Wizard, without running the entire Wizard.

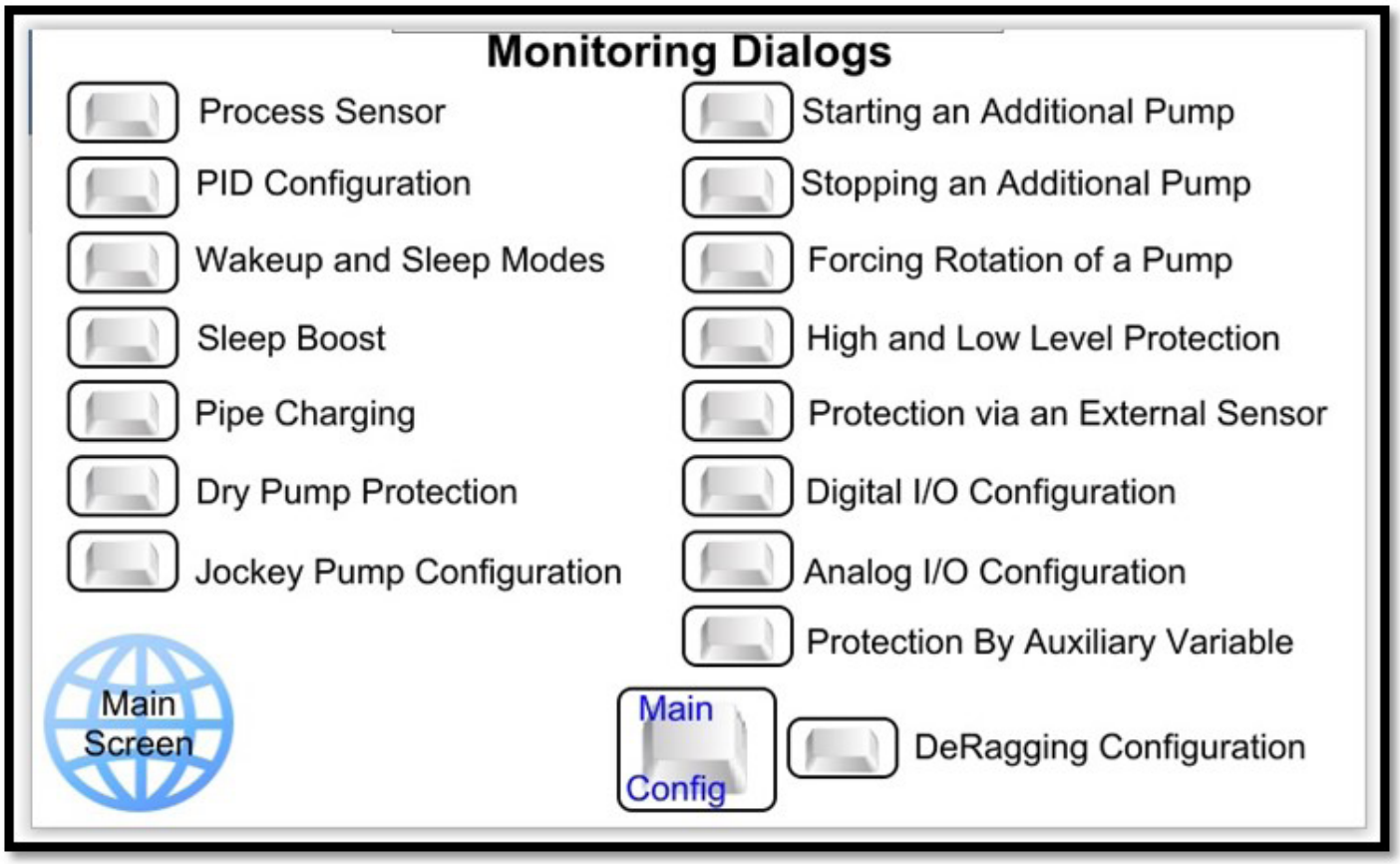

Figure 30: Monitoring Dialogues

The Digital and Analog I/O Configurations are only available if the option to use the VFD analog inputs is not selected, refer to Figure 14.

The Protection via Auxiliary Variable screen is only available if Aux_Sens. Is selected for analog input 3, refer to Figure 29.

All data subject to change without notice

The Deragging Configuration is only available when the system is not started.

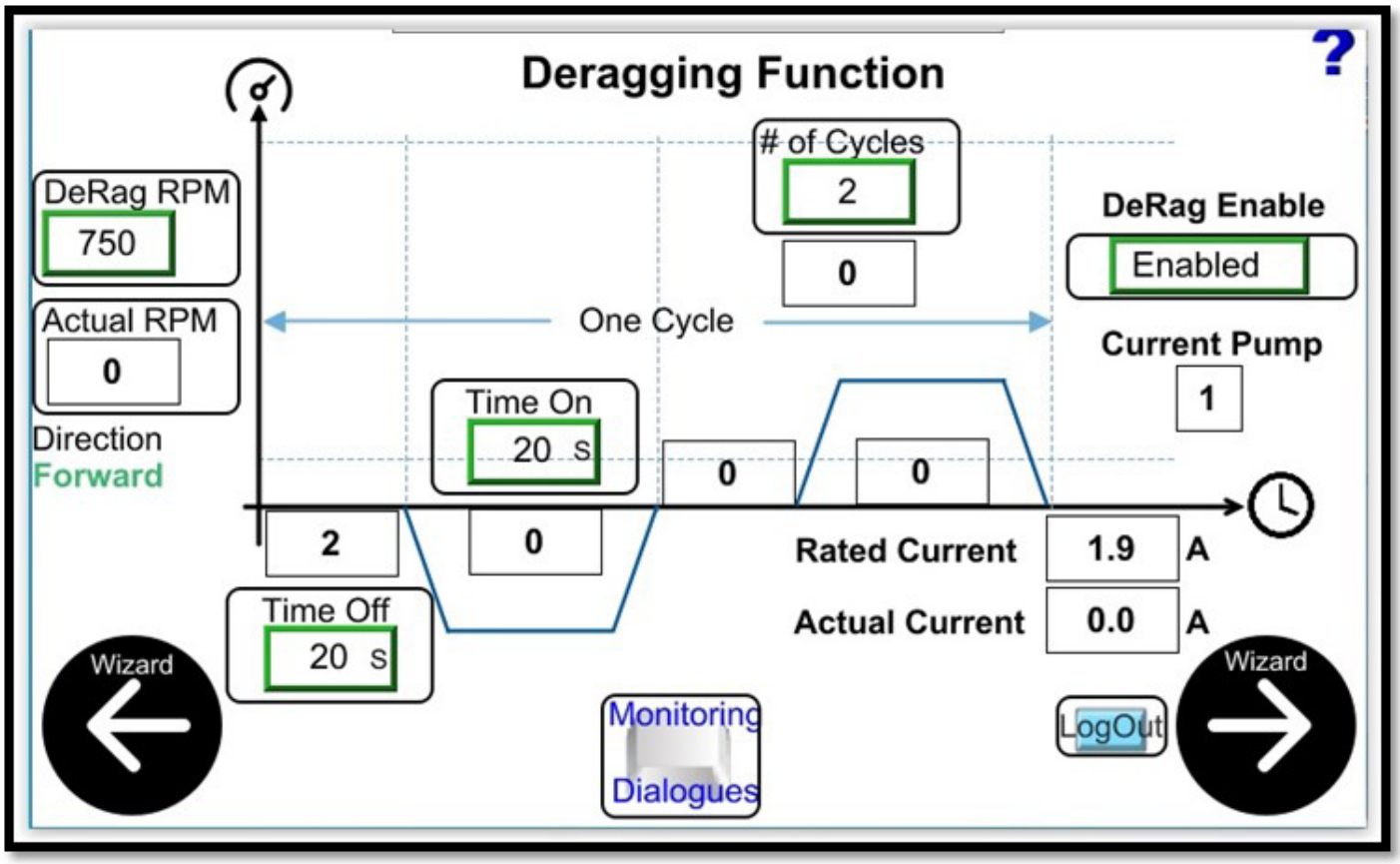

Figure 31: Deragging Configuration

One complete cycle is off for the “Time Off”, run reverse for the “Time On”, another period for the “Time Off” and finally, run forward for the “Time On”. In addition to the on and off times, the number of cycles to run and the RPM to run the drive at can be configured.

If the system is not running, enabling deragging starts the configured number of cycles running. If deragging is disabled while a cycle is running, that cycle will complete, without starting the VFD, only the timers complete and deragging will end after the final forward time on timer is done.

On a multiplex system, deragging is always run on the lead pump. To run the deragging cycles on any pump in the system, first manually select that pump as lead, refer to Figure 2, and then enable deragging. The pump deragging will be run on is indicated in Figure 31 as the “Current Pump”.

2.2.4. Schedules

Schedules are available for Mulitplex and Simplex systems. The Schedules allow for changing the system setpoint based on the day of the week and the time of day. There are three schedule modes available, shown in Figures 32, 33 and 34. To disable all schedules, us the “Sched. Enable” button at the top of the screen.

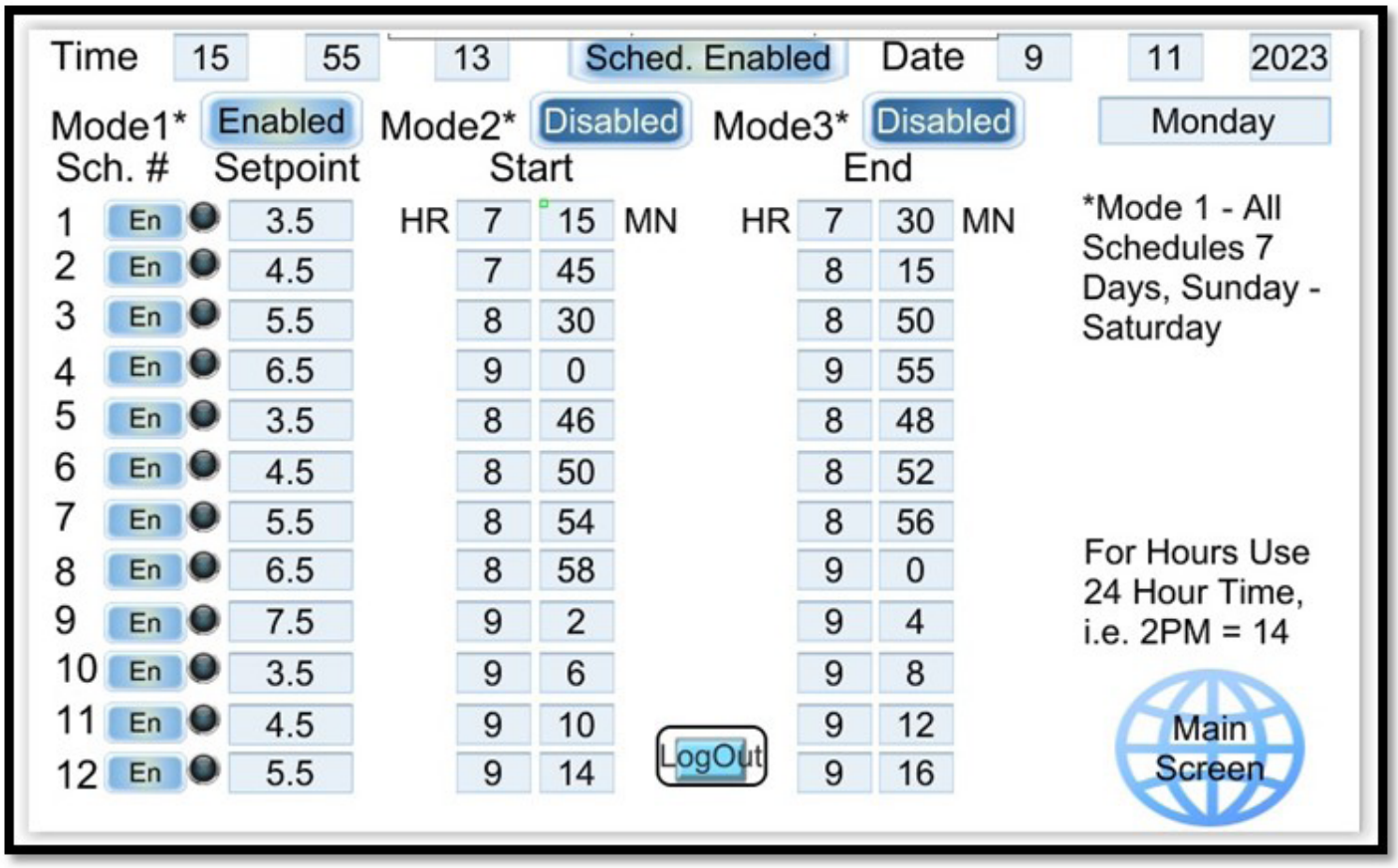

Figure 32: Mode1 Schedule

There are 12 schedules available, each of the schedules can be individually enabled/disabled. In Figure 32, schedules 1 through 4 are enabled, schedules 5-12 are disabled. In Figure 32, Schedule 1 is active, as indicated by the green light and the system setpoint is 3.5. Mode 1 is enabled in Figure 32, all 12 schedules would run every day, if the individual schedule is enabled.

The “Sched. Enabled”, Mode enable and the individual schedule enable/disable are all password protected.

All data subject to change without notice

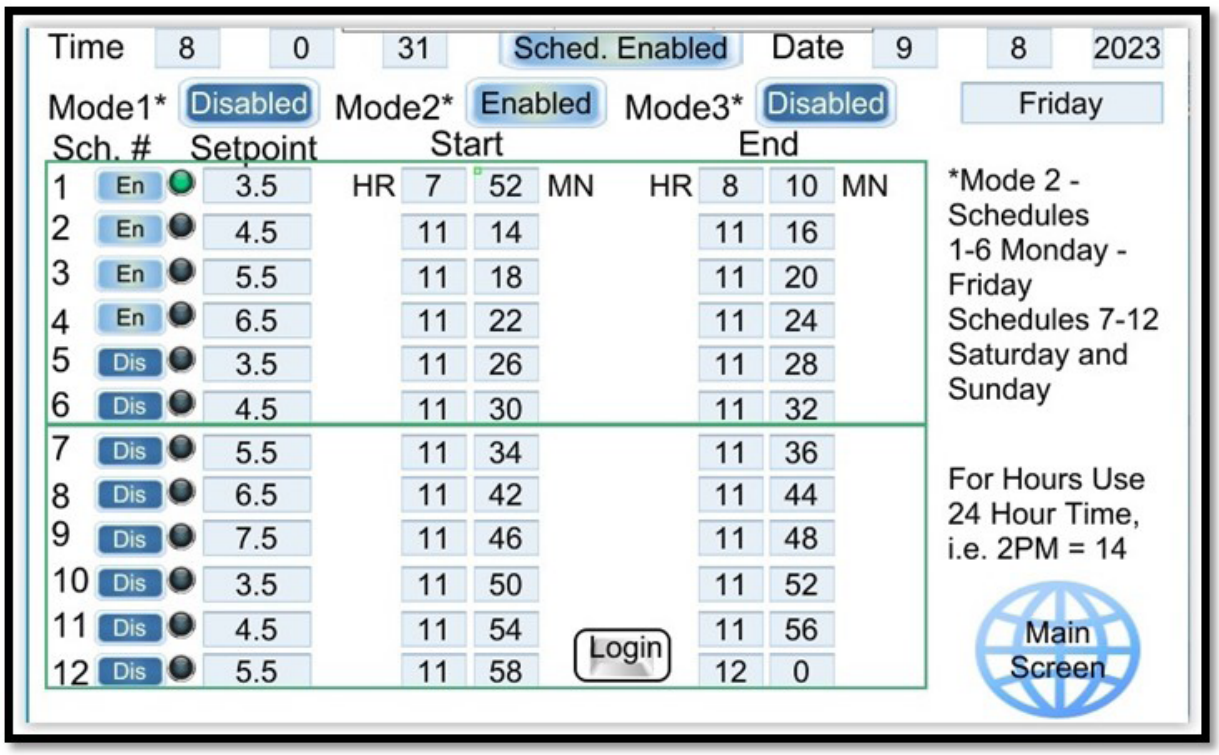

Figure 33: Mode 2 Schedule

Mode 2, shown in Figure 33 reserves 6 schedules for Monday through Friday and 6 schedules for Saturday and Sunday.

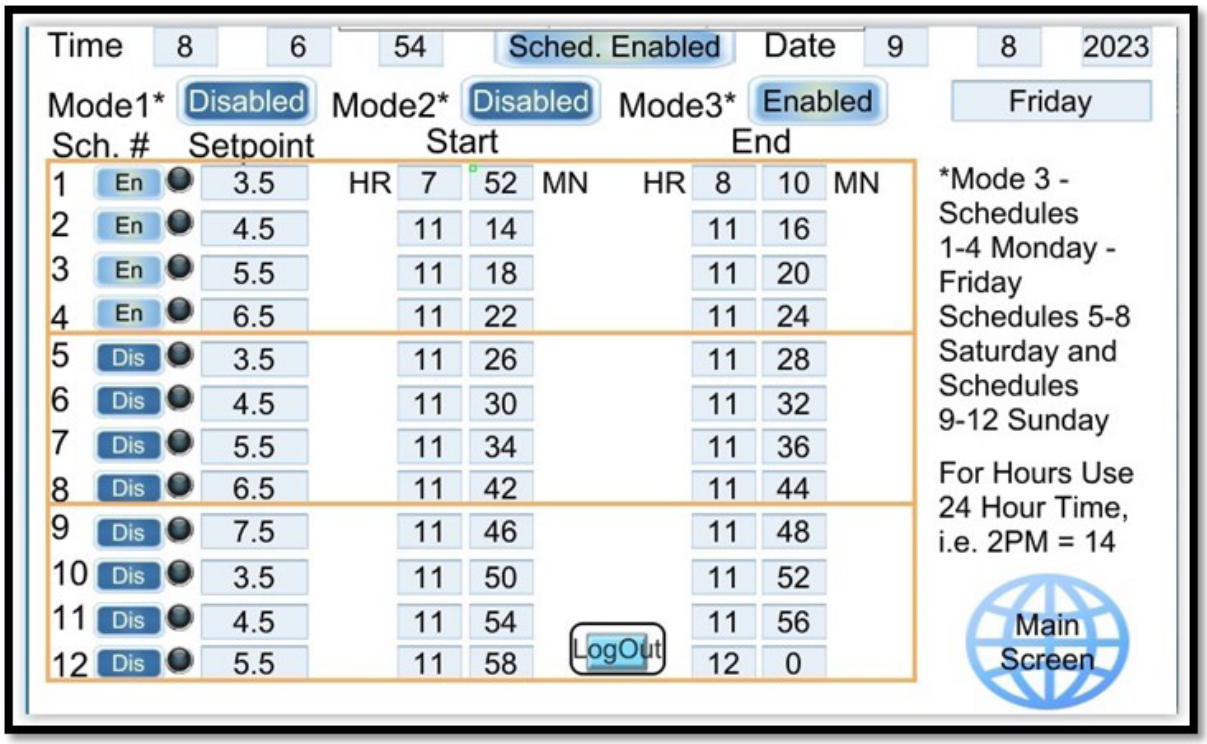

Figure 34: Mode 3 Schedule

Mode 3 reserves 4 schedules for Monday-Friday, 4 schedules for Saturday and 4 schedules for Sunday

2.2.5. PID Trending

The PID trending screen, accessed from the Wizards Screen, allows monitoring process control over time, this is done graphically, as well as provides snapshots of current system value and setpoint. The PID Trending screen also provides the ability to adjust the P, I and D parameters to fine tune the PID control.

The Setpoint can also be adjusted from the PID trending screen.

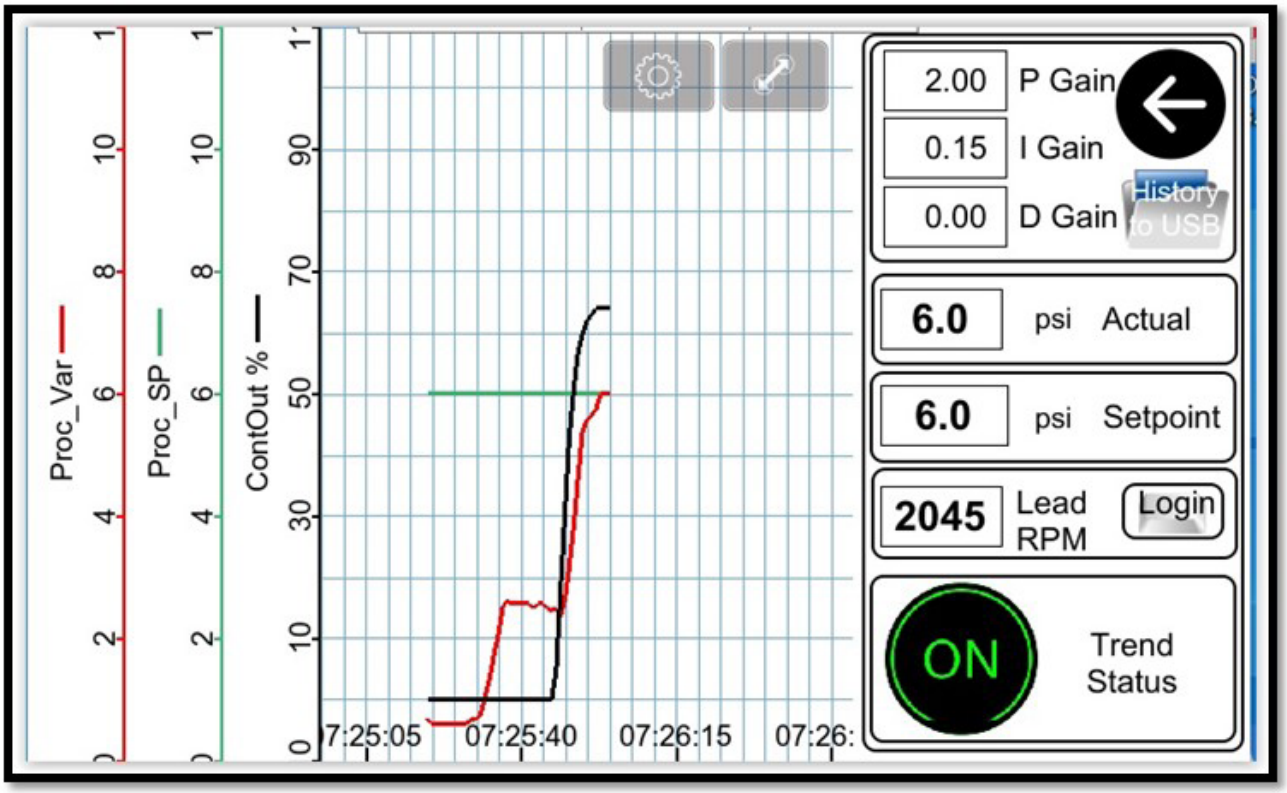

Figure 35: PID Trending

The circled portion of the trend is pipe charging, when PID control is disabled.

The Left arrow at the top right of the screen can be used to return to the Wizards Screen.

The folder shaped icon just below the arrow can be used to make a copy of the last seven days data, if a USB memory stick is installed in the HMI's USB slot.

All data subject to change without notice

2.2.6. Motor Trending

The Motor Trending screen provides monitoring of motor performance, torque, motor current and speed over time. For simplicity of the display, one motor is selected at a time for graphing performance on the trend screen.

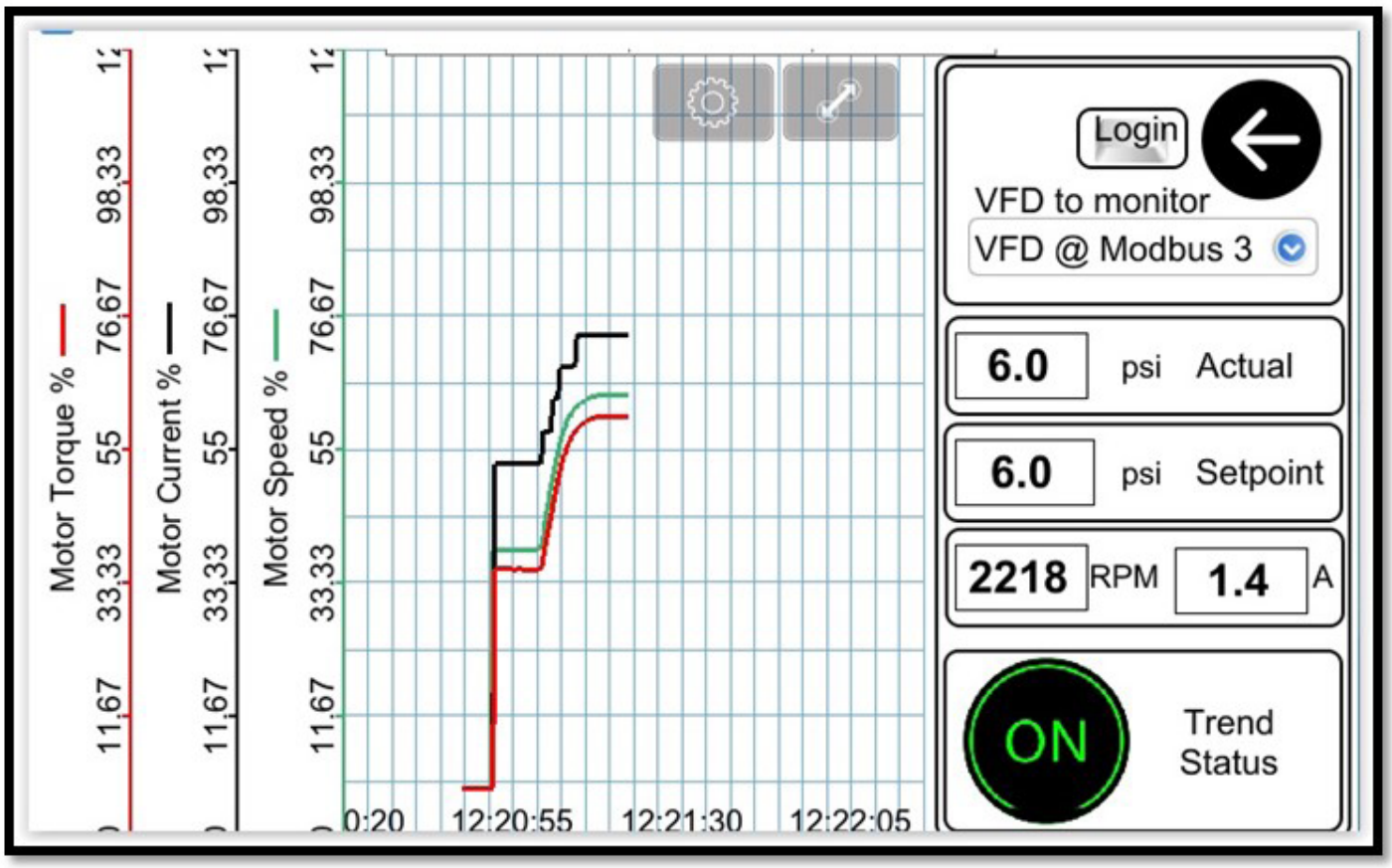

Figure 36: Motor Trending

The circled portion of the trend is pipe charging.

The Left arrow at the top right of the screen can be used to return to the Wizards Screen.

2.2.7. HMI Communications

The HMI Communications setting screen configures the HMI communications settings.

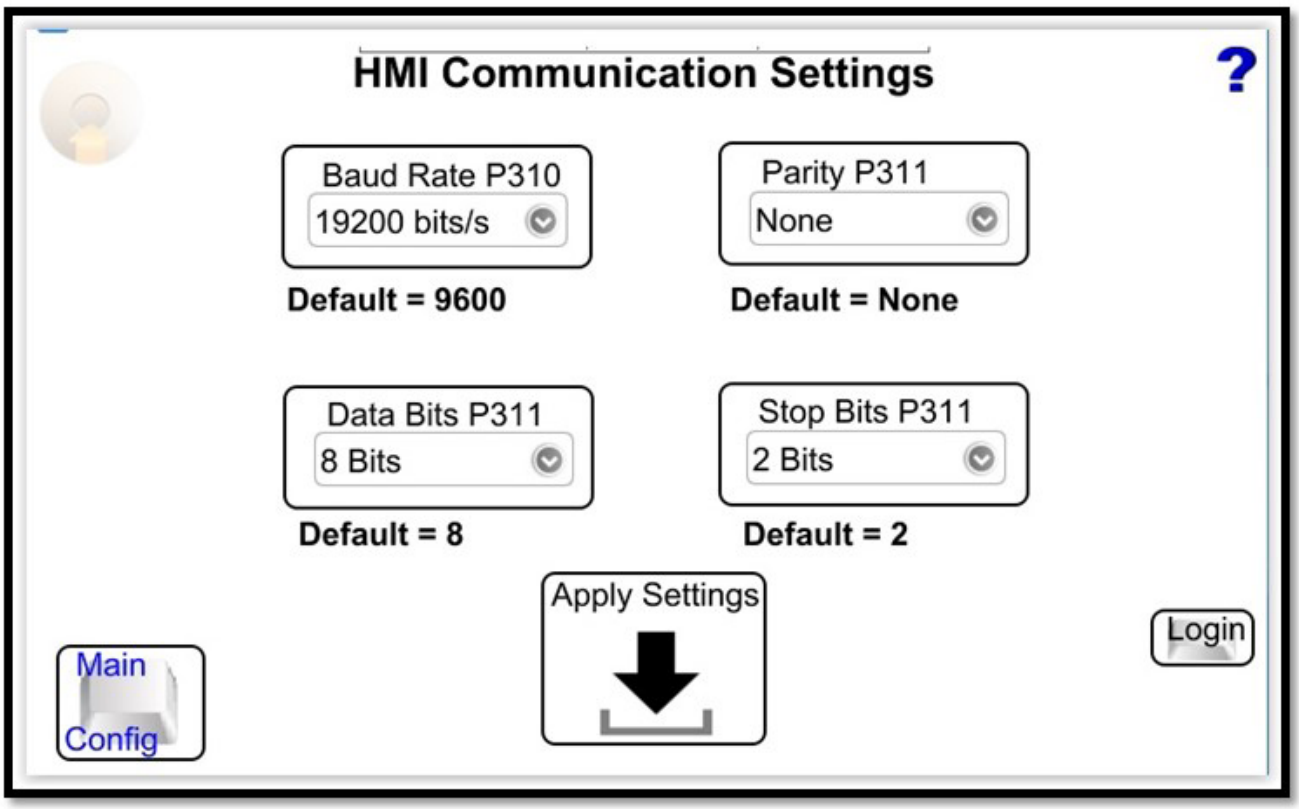

Figure 37: HMI Communications Settings

Selecting the “bull’s eye” symbol gives access to the HMI configuration menu, refer to Figure 32.

There are three parameters that have to be manually set in each VFD in the system. P308, not shown, is the Modbus RTU address for the VFD. The Modbus address is not constrained by the physical layout of the VFDs, i.e., Modbus address 1 could be on the right or left, facing the VFDs, or could be randomly located in the physical VFD sequence. Each VFD must have a unique value for parameter 308, from 1 up to 5.

P310 is the baud rate. The setting in Figure 31 sets the baud rate for the HMI, P310 in each VFD in the system must be set to match the baud rate of the HMI.

The VFD default setting is used for P311, no parity, 8 data bits and 2 stop bits. The setting of parameter 311 should be verified in each VFD in the system.

The circled button in Figure 30 allows access to the HMI configuration.

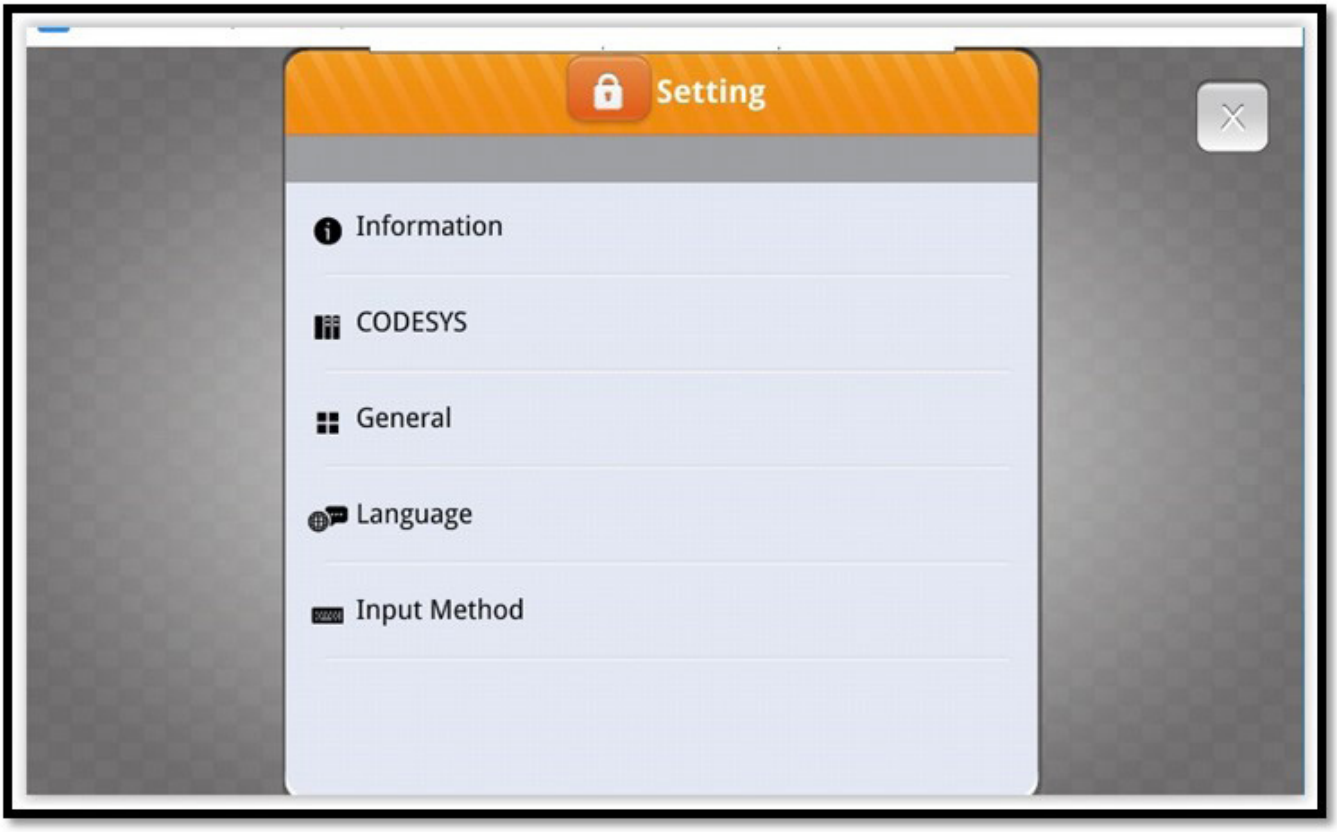

Figure 38: HMI Configuration

Selecting the lock symbol prompts for the password – as shipped the default password “111111” is used.

For more information on the HMI configuration, please refer to the HMI user manual.

2.3. Alarms and Faults

Alarms and Faults are displayed on Alarm and Fault history screens.

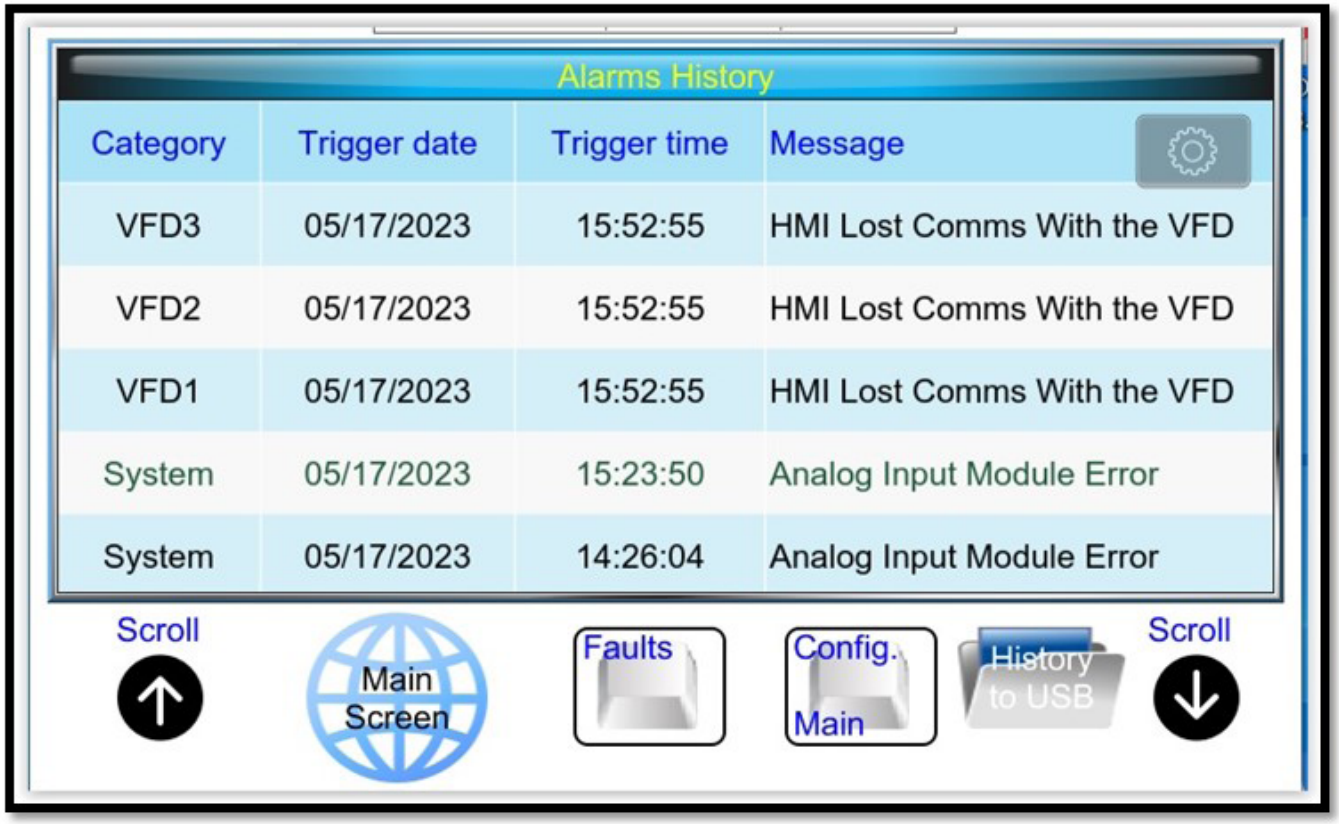

Figure 39: System Alarm History

The folder shaped icon at the bottom right of the screen can be used to make a copy of the last seven days Alarms and Faults, if a USB memory stick is installed in the HMI's USB slot.

Selecting the "gear" symbol in the upper right hand corner of the screen allows filtering by Category Number and date. The category numbers are listed in the table below.

Alarm Category Number	Fault Category Number	Description
1	8	VFD1
2	9	VFD2
3	10	VFD3
4	11	VFD4
5	12	VFD5
6		System Status
7	14	System

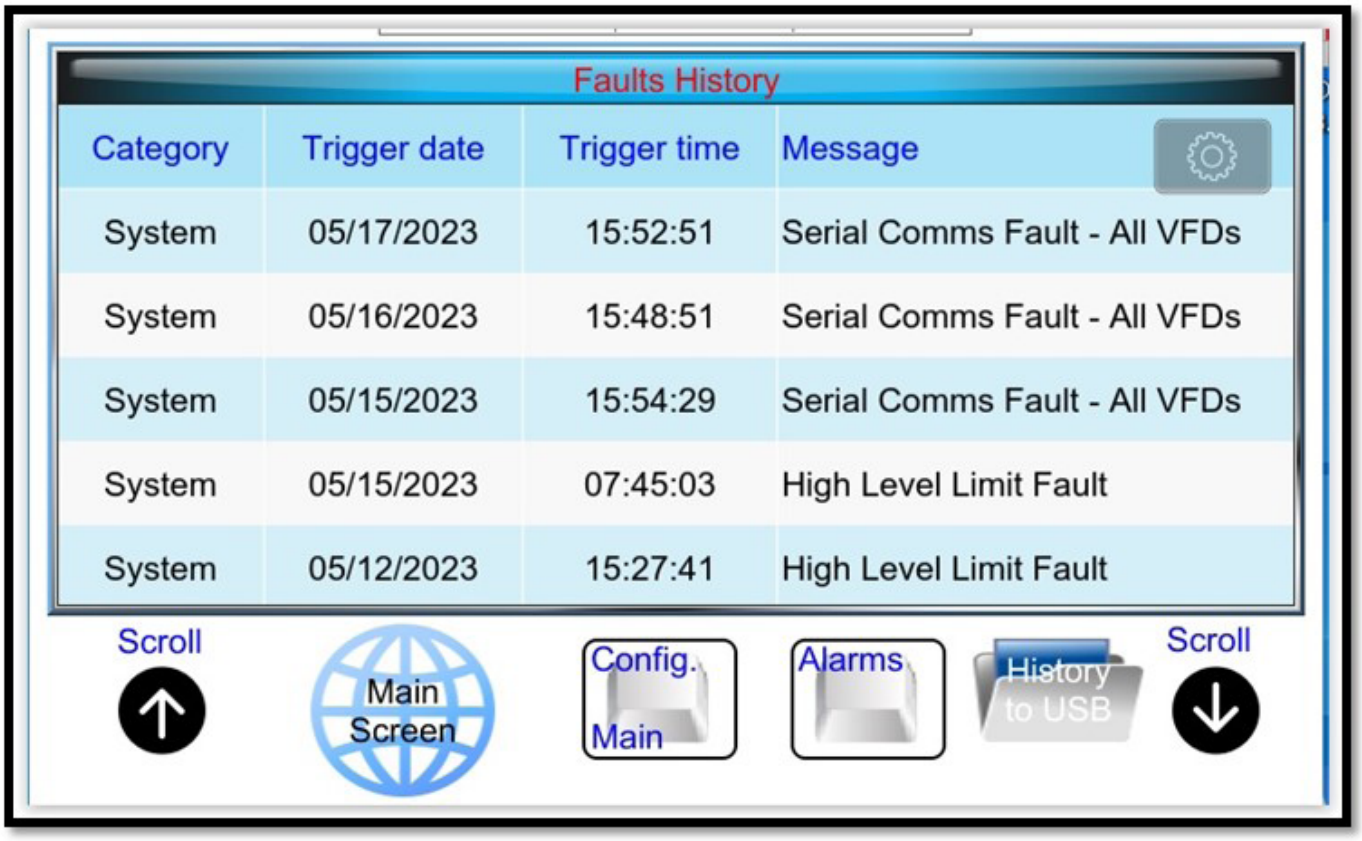

Figure 40: System Fault History

The folder shaped icon at the bottom right of the screen can be used to make a copy of the last seven days Alarms and Faults, if a USB memory stick is installed in the HMI's USB slot.

2.4. Pump Genius Control Hardware

The hardware platform for Pump Genius is the cMT2078X touchscreen with integral soft PLC running CODESYS.

Display	Display	7" TFT
	Resolution	800 x 480
	Brightness (cd/m²)	400
	Contrast Ratio	800:1
	Backlight Type	LED
	Backlight Life Time	>30,000 hrs.
	Colors	16.7M
	LCD Viewing Angle (T/B/R/L)	80/60/80/80
	Pixel Pitch (mm)	0.1926(H) x 0.179(V)
Touch Panel	Type	4-wire Resistive Type
	Accuracy	Active Area Length(X)±2%, Width(Y)±2%
Memory	Flash	4 GB
	RAM	1 GB
Processor		Quad-core RISC
I/O Port	SD Card Slot	N/A
	USB Host	USB 2.0 x 1
	USB Client	N/A
	Ethernet	LAN 1: 10/100 Base-T x 1 LAN 2: 10/100 Base-T x 1
	COM Port	Con.A: COM2 RS-485 2W/4W, COM3 RS-485 2W Con.B: COM1 RS-232 4W, COM3 RS-232 2W* MPI is not supported.
	RS-485 Dual Isolation	N/A
	CAN Bus	N/A
	HDMI	N/A
	Audio Output	N/A
RTC		Built-in
Power	Input Power	24±20%VDC
	Power Isolation	Built-in
	Power Consumption	820mA@24VDC
	Voltage Resistance	500VAC (1 min.)
	Isolation Resistance	Exceed 50MΩ at 500VDC
Specification	PCB Coating	Yes
	Enclosure	Plastic
	Dimensions WxHxD	200.3 x 146.3 x 35.0 mm
	Panel Cutout	192 x 138 mm
	Weight	Approx. 0.6 kg
	Mount	Panel mount
Environment	Protection Structure	UL Type 4X (indoor use only) / NEMA4 / IP66 Compliant Front Panel
	Storage Temperature	-20° ~ 60°C (-4° ~ 140°F)
	Operating Temperature	0° ~ 55°C (32° ~ 131°F)
	Relative Humidity	10% ~ 90% (non-condensing)
	Vibration Endurance	10 to 25Hz (X, Y, Z direction 2G 30 minutes)

Figure 41: cMT2078X Specification

All data subject to change without notice

2.4.1. I/O Coupler With Discrete I/O

If the option to use I/O in the Pump Genius control cabinet is the one selected, the Weintek iR-ETN40R communicates with the CODESYS PLC in the cMT2078X.

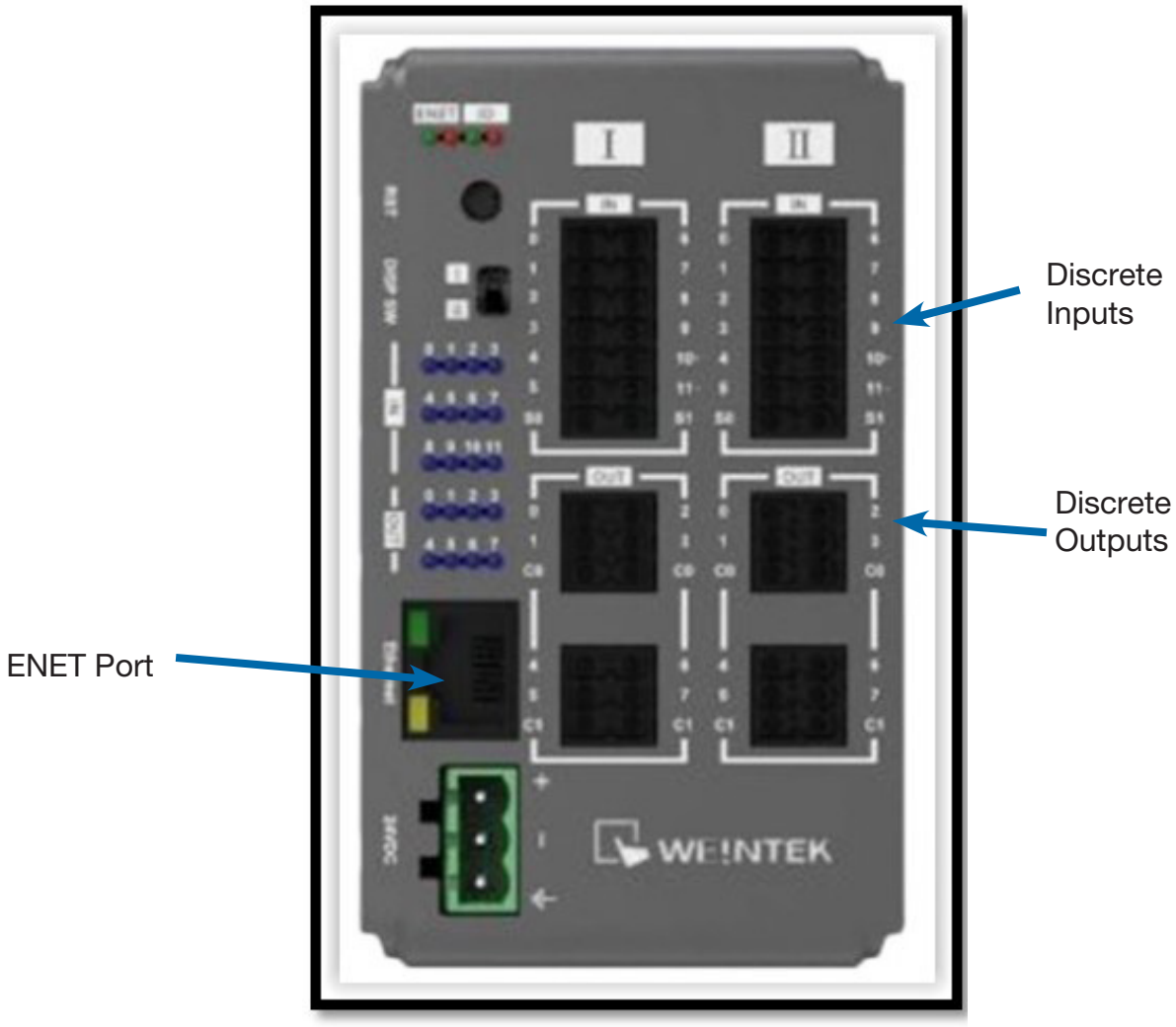

Figure 42: iR-ETN40R Ethernet Coupler With Remote I/O

In addition to the Ethernet port for connection to the cMT2078X, the iR-ETN40R has 24 discrete inputs, 12 on side I and 12 on side II, and 16 discrete outputs, 8 on side I and 8 on side II, refer to Figure 25 for the configuration of the discrete I/O.

2.4.2. Analog Input Module

The process variable sensor(s) and the auxiliary variable sensor, if used, are wired to an iR-AI04-VI analog input module, refer to Figure 26.

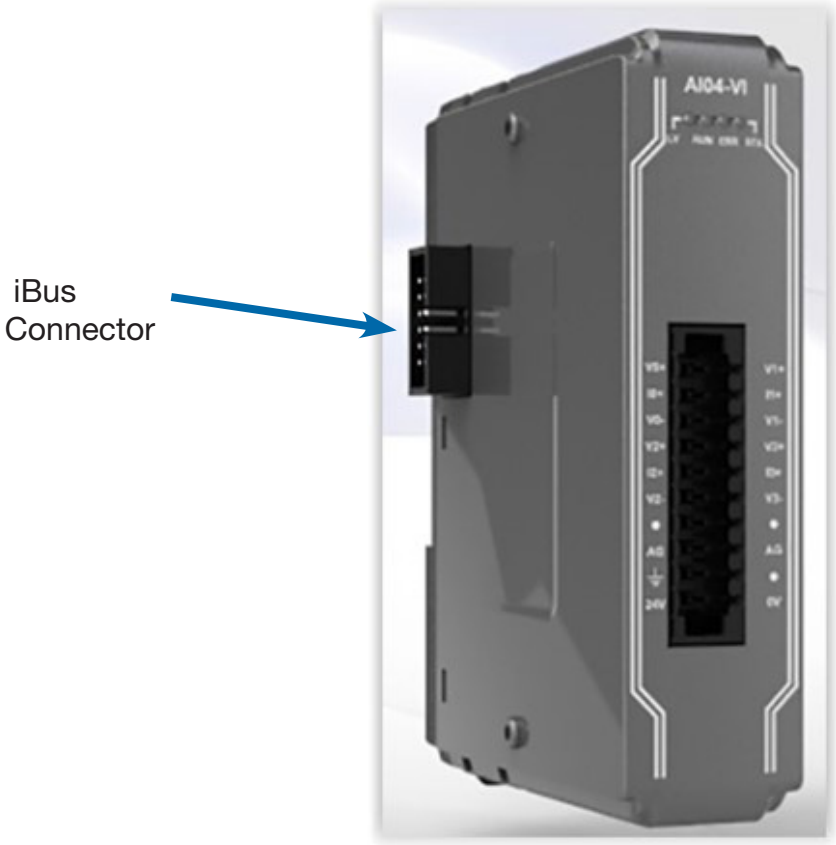

Figure 43: iR-AI04-VI 4-Channel Analog Input

The iR-ETN40R and the iR-AI04-VI both snap onto DIN rail and are slid together, making electrical connection through the iBus connector. The female iBus connector is not shown in Figure 37, but is on the right side facing the iR-ETN40R.

2.5. HMI Data Servers

Two data servers are available from LAN2 of the HMI: Modbus TCP and BACnet IP. Appendices A and B show the tag mapping of Pump Genius tags to Modbus and BACnet tags.

Appendix A: Modbus Server Tag Definitions

There is a Modbus TCP server avaialble in the Pump Genius HMI. Pump Genius data can be monitored by a Modbus TCP capable device using the mapping presented below.

The Modbus TCP server is accessable through the LAN2 connection on the Pump Genius HMI. For information on setting the IP address for LAN2, please refer to the Weintek “EasyBuilderPro_ UserManual”. The port number is 502.

An export from the PG HMI of the Modbus tag mapping is available if requested.

Description	Mapping Address
Aux Setpoint Active	10071
Boost Active	10070
Control Setpoint	30001
PID Controller Output	30060
Pipe Charge	10046
Process Variable	30050
Sleep Mode	10045
System Config. Error	10049
VFD1 Alarm	10065
VFD1 Alarm Number	30024
VFD1 Current	30008
VFD1 Enable Pump	10050
VFD1 Fault	10074
VFD1 Fault Number	30029
VFD1 Lead	10040
VFD1 Maintenance	10035
VFD1 Remote	10060
VFD1 Running	10055
VFD1 Runtime	30003
VFD1 Speed	30018
VFD1 Torque	30013
VFD2 Alarm	10066
VFD2 Alarm Number	30025
VFD2 Current	30009
VFD2 Enable Pump	10051
VFD2 Fault	10075
VFD2 Fault Number	30030
VFD2 Lead	10041
VFD2 Maintenance	10036
VFD2 Remote	10061
VFD2 Running	10056
VFD2 Runtime	30004
VFD2 Speed	30019
VFD2 Torque	30014

Description	Mapping Address
VFD3 Alarm	10067
VFD3 Alarm Number	30026
VFD3 Current	30010
VFD3 Enable Pump	10052
VFD3 Fault	10076
VFD3 Fault Number	30031
VFD3 Lead	10042
VFD3 Maintenance	10037
VFD3 Remote	10062
VFD3 Running	10057
VFD3 Runtime	30005
VFD3 Speed	30020
VFD3 Torque	30015
VFD4 Alarm	10068
VFD4 Alarm Number	30027
VFD4 Current	30011
VFD4 Enable Pump	10053
VFD4 Fault	10077
VFD4 Fault Number	30032
VFD4 Lead	10043
VFD4 Maintenance	10038
VFD4 Remote	10063
VFD4 Running	10058
VFD4 Runtime	30006
VFD4 Speed	30021
VFD4 Torque	30016
VFD5 Alarm	10069
VFD5 Alarm Number	30028
VFD5 Current	30012
VFD5 Enable Pump	10054
VFD5 Fault	10078
VFD5 Fault Number	30033
VFD5 Lead	10044
VFD5 Maintenance	10039
VFD5 Remote	10064
VFD5 Running	10059
VFD5 Runtime	30007
VFD5 Speed	30022
VFD5 Torque	30017

Appendix B: BACnet IP Server Tag Definitions

There is a BACnet/IP server avaialble in the Pump Genius HMI. Pump Genius data can be monitored by a BACnet IP capable device using the mapping presented below.

The BACnet/IP server is accessable through the LAN2 connection on the Pump Genius HMI. For information on setting the IP address for LAN2, please refer to the Weintek "EasyBuilderPro_ UserManual". The port number is 47808.
The property of the tag used is always the Present Value, i.e., in the Pump Genius HMI, the value for the Process Variable is transferred to BACnet tag:
"(2,1)AnalogValue_1.PresentValue(ID#85)".
An export of the BACnet tags from the PG HMI is available if requested.

Device_ID	Instance	Object_Name	Description
4194302	0	AnalogValue_0	Control Setpoint
4194302	1	AnalogValue_1	Process Variable
4194302	2	AnalogValue_2	VFD1 Runtime
4194302	3	AnalogValue_3	VFD2 Runtime
4194302	4	AnalogValue_4	VFD3 Runtime
4194302	5	AnalogValue_5	VFD4 Runtime
4194302	6	AnalogValue_6	VFD5 Runtime
4194302	7	AnalogValue_7	VFD1 Current
4194302	8	AnalogValue_8	VFD2 Current
4194302	9	AnalogValue_9	VFD3 Current
4194302	10	AnalogValue_10	VFD4 Current
4194302	11	AnalogValue_11	VFD5 Current
4194302	12	AnalogValue_12	VFD1 Torque %
4194302	13	AnalogValue_13	VFD2 Torque %
4194302	14	AnalogValue_14	VFD3 Torque %
4194302	15	AnalogValue_15	VFD4 Torque %
4194302	16	AnalogValue_16	VFD5 Torque %
4194302	17	AnalogValue_17	VFD1 Speed
4194302	18	AnalogValue_18	VFD2 Speed
4194302	19	AnalogValue_19	VFD3 Speed
4194302	20	AnalogValue_20	VFD4 Speed
4194302	21	AnalogValue_21	VFD5 Speed
4194302	22	AnalogValue_22	PID Controller Output %
4194302	23	AnalogValue_23	VFD1 Alarm Number
4194302	24	AnalogValue_24	VFD2 Alarm Number
4194302	25	AnalogValue_25	VFD3 Alarm Number
4194302	26	AnalogValue_26	VFD4 Alarm Number
4194302	27	AnalogValue_27	VFD5 Alarm Number
4194302	28	AnalogValue_28	VFD1 Fault Number

All data subject to change without notice

Device_ID	Instance	Object_Name	Description
4194302	29	AnalogValue_29	VFD2 Fault Number
4194302	30	AnalogValue_30	VFD3 Fault Number
4194302	31	AnalogValue_31	VFD4 Fault Number
4194302	32	AnalogValue_32	VFD5 Fault Number
4194302	0	BinaryOutput_0	PG Enabled
4194302	1	BinaryOutput_1	VFD1 Lead
4194302	3	BinaryOutput_3	VFD1 Enable Pump
4194302	4	BinaryOutput_4	VFD1 Running
4194302	5	BinaryOutput_5	VFD1 Remote
4194302	6	BinaryOutput_6	VFD1 Fault
4194302	7	BinaryOutput_7	VFD1 Alarm
4194302	9	BinaryOutput_9	VFD2 Lead
4194302	11	BinaryOutput_11	VFD2 Enable Pump
4194302	12	BinaryOutput_12	VFD2 Running
4194302	13	BinaryOutput_13	VFD2 Remote
4194302	14	BinaryOutput_14	VFD2 Fault
4194302	15	BinaryOutput_15	VFD2 Alarm
4194302	17	BinaryOutput_17	VFD3 Lead
4194302	19	BinaryOutput_19	VFD3 Enable Pump
4194302	20	BinaryOutput_20	VFD3 Running
4194302	21	BinaryOutput_21	VFD3 Remote
4194302	22	BinaryOutput_22	VFD3 Fault
4194302	23	BinaryOutput_23	VFD3 Alarm
4194302	25	BinaryOutput_25	VFD4 Lead
4194302	27	BinaryOutput_27	VFD4 Enable Pump
4194302	28	BinaryOutput_28	VFD4 Running
4194302	29	BinaryOutput_29	VFD4 Remote
4194302	30	BinaryOutput_30	VFD4 Fault
4194302	31	BinaryOutput_31	VFD4 Alarm
4194302	33	BinaryOutput_33	VFD5 Lead
4194302	35	BinaryOutput_35	VFD5 Enable Pump
4194302	36	BinaryOutput_36	VFD5 Running
4194302	37	BinaryOutput_37	VFD5 Remote
4194302	38	BinaryOutput_38	VFD5 Fault
4194302	39	BinaryOutput_39	VFD5 Alarm
4194302	4194302	Weintek HMI	Weintek BACnet Server

WEG's scope of solutions is not limited to the products and solutions presented in this brochure.
Contact WEG for information on additional products and solutions.

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US.PG.HMI/PLC.Description.of.Operation:50136448.11.2023

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